FAIRBANKS NORTH STAR BOROUGH
Box 1267, Fairbanks, Alaska 99707

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ENERGY COSTS, CONSUMPTION AND IMPACTS IN FAIRBANKS

by

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Prepared for the TOWN MEETING ON ENERGY March 26, 1977

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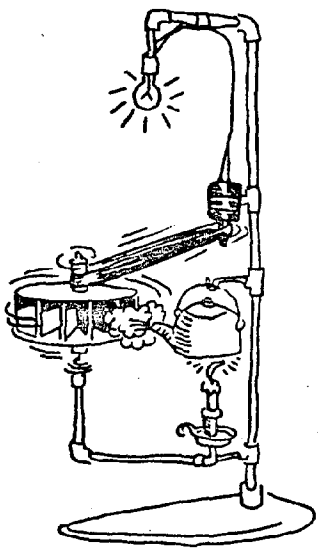

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Special thanks to Rich Seifert who suggested and encouraged the preparation of this special report as part of the Town Meeting on Energy.

SUMMARY OF TABLES AND FIGURES

INTRODUCTION

The trans Alaska oil pipeline was built in response to energy needs. While the pipeline may help to solve some global energy problems, it has created many changes related to the cost and consumption of energy in the Fairbanks area. Some of these changes are directly related to pipeline construction, such as the increased air and highway activities to transport materials and persons needed in the pipeline construction project. Other changes are related to the population growth and commercial growth in Fairbanks which have resulted from pipeline construction and associated activities. More people has meant more automobiles and more houses and more commercial establishments, which in turn have meant a greater consumption of energy. Increased consumption of energy has been accompanied by changes in the types of energy consumed and changes in costs. Use of fossil fuels requires combustion creating by-products which contaminate the air. And, thus the increase in energy consumption in Fairbanks ultimately has ramifications on air quality.

As part of its progress since 1974, the Fairbanks North Star Borough Impact Information Center has monitored the effects of the trans Alaska oil pipeline on the Fairbanks area, including effects related to energy. Regular reports of the Impact Information Center have considered heating oil prices and heating costs (Reports 6, 8, 9, 11, 12, 13, 22, 31, and 32), demands and responses on public utilities electrical services (Reports 1, 2, 18, 23, 25), utility rates and energy costs (Report 31), vehicle traffic in the Fairbanks metropolitan area (Reports 2, 5, 7, 12, 14, 17-20, 23-33), increases in motor vehicle registrations (Reports 3, 12, 19,34), freight and freight rates (Reports 4, 13, 15), air transportation activities (Reports 1, 6, 17, 18, 19, 20, 23, 24, 26, 28, 31, 34), motor fuel consumption (Reports 11, 12, 34), air quality (Reports 8, 9, 13, 22-25), and other aspects which relate to energy in Fairbanks.

The Town Meeting on Energy, March 26, 1977, provided the incentive to pull together the diverse information about energy in Fairbanks collected by the Impact Information Center and to collect additional data to provide a more comprehensive picture. The relationship between energy and the construction of the trans Alaska oil pipeline suggests a variety of topics, including rate of consumption, causes of changes in consumption patterns, costs of energy, and air quality. To adequately cover these topics, the Impact Center joined forces with the Environmental Services Department of the Fairbanks North Star Borough and enlisted the aid of a variety of researchers. The following report on changes in energy consumption, costs, and air quality represents a cooperative effort of many interested persons and organizations.

Chapter I

ENERGY CONSUMPTION OVERVIEW, 1970-1975

Introduction

Fuel in Fairbanks comes from four primary sources: fuel oil, gasoline, coal and electricity imported from Healy. This chapter summarizes recent trends in the consumption of each of these energy sources in the Fairbanks North Star Borough. Most of the quantitative data were provided by Dr. Sue Ann Bowling and Dr. Carl Benson, of the Geophysical Institute, who are compiling this data for a study funded by the Borough Environmental Services Department and the Environmental Protection Agency. This study will attempt to measure the quantities and types of fuels being burned in the Borough to estimate the emissions from fuels into the surrounding air. This inventory is a key component in a comprehensive study of air quality. For a discussion of the effects of energy consumption on air quality in Fairbanks, see Chapter VI.

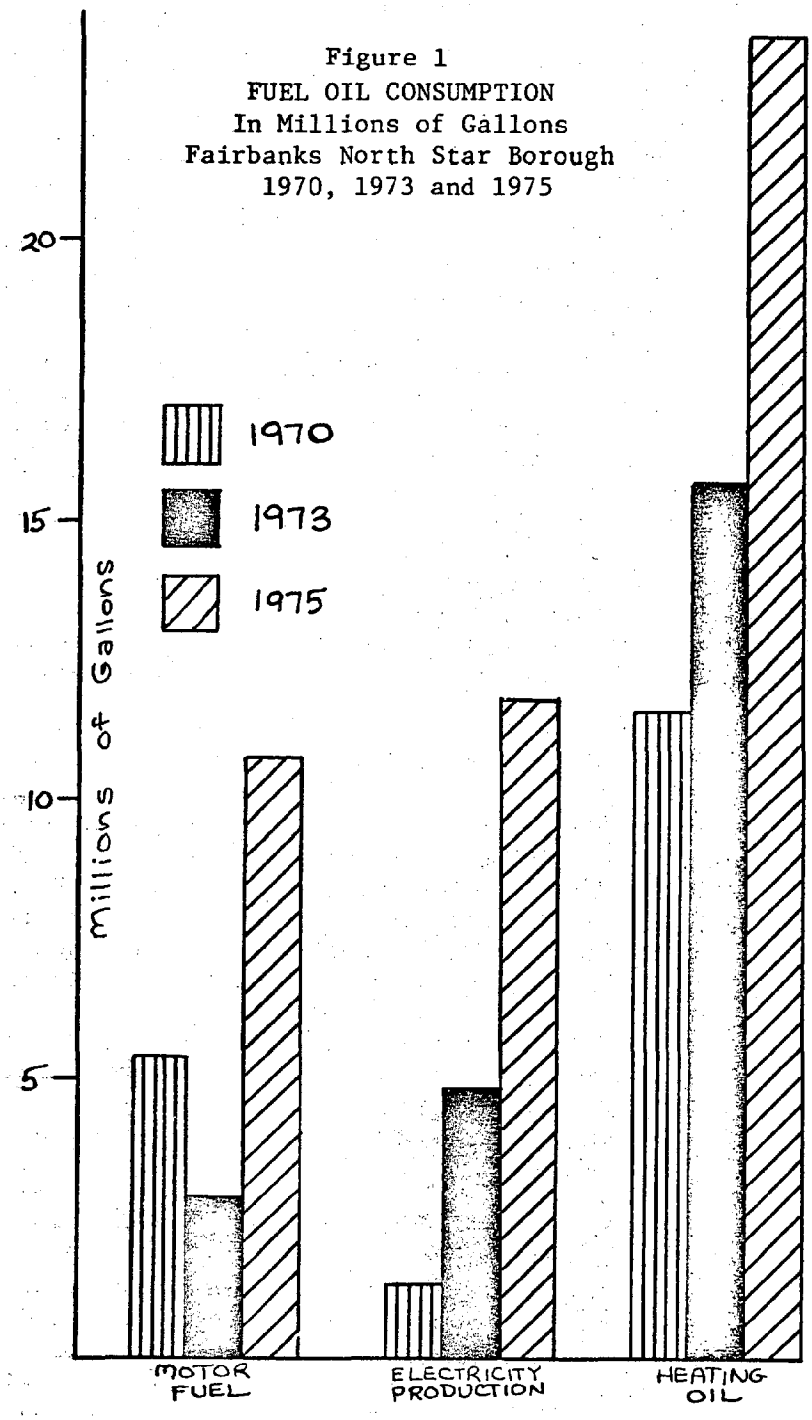
Fuel Oil

In 1975 about 46 million gallons of fuel oil were consumed in the Fairbanks area. This is a 156 percent increase over the 1970 total of 18 million gallons. Fuel oil has three primary uses in Fairbanks: 1) as a diesel motor fuel, 2) for the generation of electricity, and 3) heat homes and buildings. The consumption of these types of fuel oil for 1970, 1973 and 1975 is summarized in Figure 1 and Table 1.

Diesel Fuel - The consumption of diesel fuel, which is used primarily for trucks and heavy equipment, has fluctuated widely in recent years as a result of construction of the trans Alaska oil pipeline. In 1970, due to truck transport of materials to the North Slope over the "ice road," diesel fuel consumption in the Fairbanks area was an estimated 5.4 million gallons. However, when pipeline construction was delayed until 1974, slowdown in trucking activity dropped diesel consumption to 2.9 million gallons in 1973. With completion of the North Slope Haul Road, pipeline freight trucking escalated consumption of diesel fuel in Fairbanks to 10.7 million gallons in 1975.

Electricity Generation - The use of fuel oil to generate electric power has increased dramatically in Fairbanks from only 1.3 million gallons in 1970 to 11.8 million gallons in 1975. Nearly all of this increase may be attributed to consumption by Golden Valley Electric Association (GVEA). Most of the recent development in Fairbanks has occurred in areas in which electric service is provided only by GVEA. As a result of this residential and commercial growth, GVEA's coal-fired Healy generating plant was insufficient to meet the demand for

Figure 1
FUEL OIL CONSUMPTION
In Millions of Gallons
Fairbanks North Star Borough
1970, 1973 and 1975



Source: Dr. Sue Ann Bowling and Dr. Carl Benson, UA Geophysical Institute

Table 1
FUEL OIL CONSUMPTION
Fairbanks North Star Borough
1970, 1973 and 1975

	In Thousands of Gallons						
	Motor Fuel	Heating Oil	---Fuel Oil for Power Generation--- Military	MUS	GVEA	Sub-Total	Total
1970							
Jan.	107	1,768	8	216	0	224	2,099
Feb.	172	1,473	17	104	11	132	1,777
Mar.	334	1,061	4	77	6	87	1,482
Apr.	640	951	17	64	11	92	1,683
May	427	487	4	42	44	90	1,004
June	527	427	4	32	163	199	1,153
July	516	346	4	30	51	85	947
Aug.	575	579	4	46	11	61	1,215
Sept.	675	725	4	42	16	62	1,462
Oct.	482	845	4	3	26	33	1,360
Nov.	386	1,224	4	7	59	70	1,680
Dec.	552	1,715	147	17	33	197	2,464
Total	5,395	11,601	221	680	431	1,332	18,328
1973							
Jan.	224	2,591	8	33	1,053	1,094	3.909
Feb.	83	1,854	8	9	525	542	2,479
Mar.	60	1,485	8	10	640	658	1,545
Apr.	66	1,001	8	6	44	58	1,125
May	273	715	8	4	5	17	1,005
June	360	422	8	3	9	20	802
July	420	466	13	128	13	154	1,040
Aug.	443	688	8	109	22	139	1,270
Sept.	364	806	13	12	315	340	1,510
Oct.	326	1,372	8	0	398	406	2,104
Nov.	153	1,933	13	15	619	647	2,733
Dec.	159	2,278	8	101	585	694	3,131
Total	2,927	15,610	113	430	4,227	4,770	23,307
1975							
Jan.	456	3,391	54	104	1,686	1,844	5,691
Feb.	598	2,572	19	46	1,008	1,073	4,243
Mar.	850	2,018	22	12	1,069	1,103	3,971
Apr.	872	1,769	17	66	485	568	3,209
May	802	927	0	8	467	475	2,204
June	928	925	0	4	88	92	1,945
July	792	803	0	2	89	91	1,686
Aug.	993	992	0	5	474	479	2,464
Sept.	1,156	1,443	24	4	829	857	3,456
Oct.	1,199	2,105	24	23	1,159	1,206	4,510
Nov.	1,253	3,284	36	24	2,018	2,078	6,615
Dec.	797	3,322	41	89	1,781	1,911	6,030
Total	10,684	23,550	237	385	11,152	11,774	46,008

Source: Dr. Sue Ann Bowling and Dr. Carl Benson, UA Geophysical Institute

electricity. GVEA has relied increasingly upon power generated by fuel oil. Only 5 percent of the fuel oil used to generate electricity in 1975 was consumed by the Municipal Utilities System (MUS) and Fort Wainwright, with the remaining 95 percent consumed by GVEA.

Heating Oil - Except during the summer months, heating oil is the largest component of fuel oil consumption in Fairbanks. Whereas consumption of diesel fuel has fluctuated widely due to changes in transportation activity, the consumption of heating oil, which is tied primarily to population levels, has shown steady increase. As Figure 2 illustrates, the consumption of heating fuel in Fairbanks follows a seasonal cycle of very low consumption in summer and very high consumption in winter. Between 1970 and 1973 heating oil consumption in Fairbanks grew at an average annual rate of about 9 percent. Population growth associated with pipeline construction caused the use of heating oil to increase at an average annual rate of about 23 percent during 1974 and 1975.

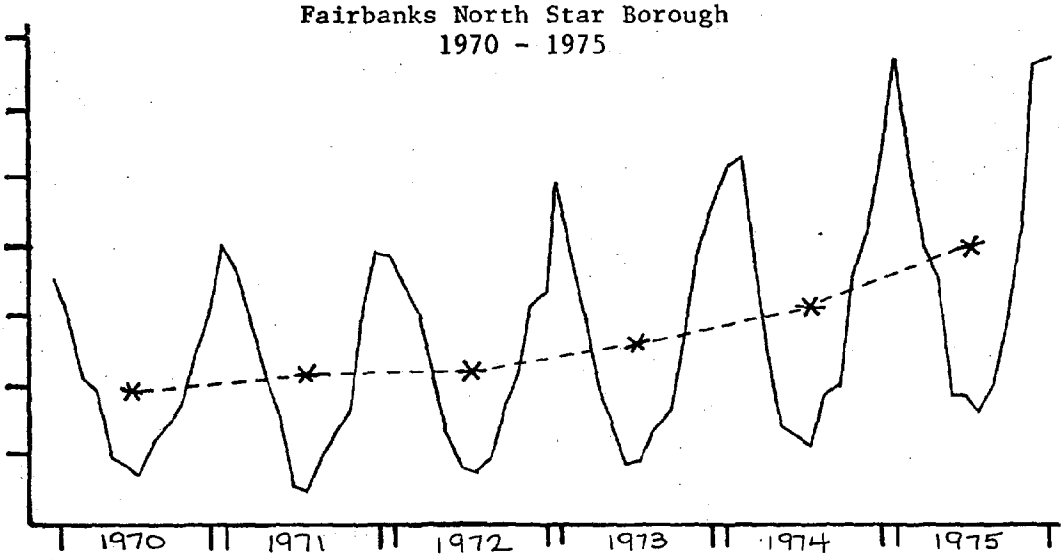
Gasoline

Between 1970 and 1973 gasoline consumption in Fairbanks averaged 16 to 17 million gallons per year and increased only 5 percent during the four-year period. However, the pipeline boom which was accompanied by increases in population, vehicles, traffic and air transportation activity caused the consumption of gasoline to increase to 31.4 million gallons in 1975, 85 percent more than the 17 million gallons consumed in 1973. For information on increases in air transportation activity, vehicle traffic, and motor vehicle registrations see Chapter
In contrast to fuel oil consumption, Figure 3 shows that the use of gasoline peaks in the summer months.

Coal

Fairbanks is the only large city in Alaska which relies on coal as a major energy source. Coal is transported to Fairbanks from mines in Healy via the Alaska Railroad. GVEA used to operate a coal-fired generator in Fairbanks; however, it was closed when GVEA's Healy plant became fully operational in 1968. As Figure 4 shows, in contrast to major increases in the use of fuel oil and gasoline, coal consumption has remained virtually unchanged in recent years. In 1967 394,000 tons of coal were consumed in Fairbanks, compared to 393,000 tons in 1975, a difference of less than 1 percent. Ninety percent of the coal transported to Fairbanks in 1975 was used to generate electric power with 34 percent consumed by the MUS, 9 percent by the University of Alaska and 54 percent by Ft. Wainwright. The remaining 4 percent of the coal was used for home heating. Data on monthly coal consumption for the generation of electric power is given in Table 4.

Figure 2
HEATING OIL CONSUMPTION
Fairbanks North Star Borough
1970 - 1975



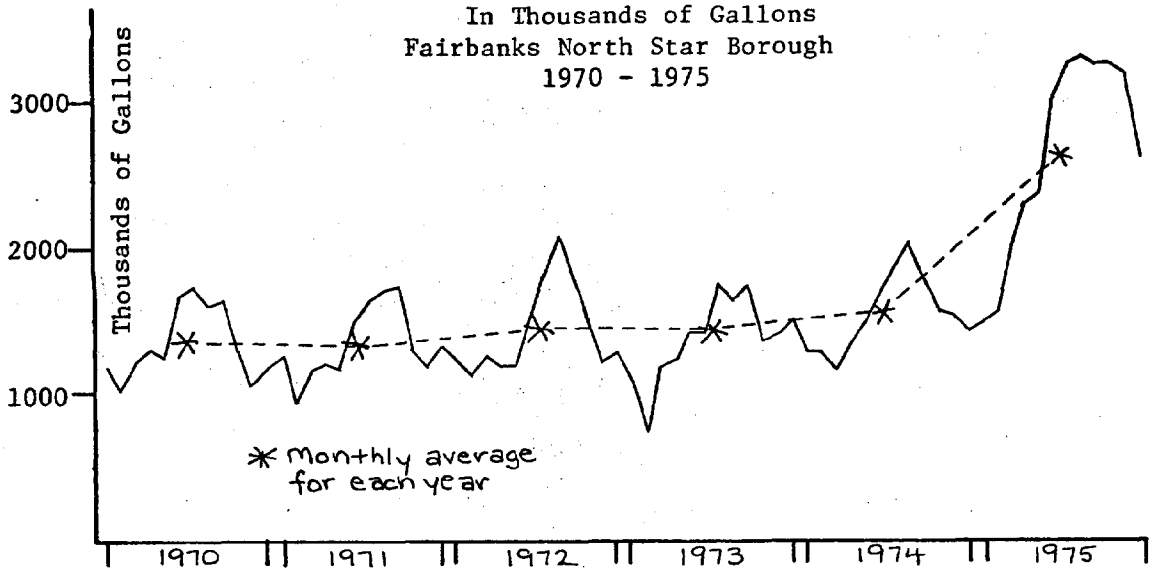
Source: Dr. Sue Ann Bowling and Dr. Carl Benson, US Geophysical Institute

Table 2
HEATING OIL CONSUMPTION
Fairbanks North Star Borough
1970 - 1975

	1970	1971	1972	1973	1974	1975
January	1,768	2,006	1,910	2,591	2,549	3,391
February	1,473	1,797	1,681	1,854	2,638	2,572
March	1,061	1,426	1,473	1,485	1,908	2,018
April	951	1,071	1,064	1,001	1,235	1,769
May	487	769	623	715	716	927
June	427	276	397	422	658	925
July	346	237	346	466	590	803
August	579	489	451	688	917	992
September	725	655	820	806	1,004	1,443
October	845	811	1,064	1,372	1,782	2,105
November	1,224	1,468	1,565	1,933	2,106	3,284
December	1,715	1,946	1,671	2,278	2,585	3,322
Total	11,601	12,951	13,065	15,610	18,688	23,550
Monthly Ave.	967	1,079	1,089	1,301	1,557	1,963

Source: Dr. Sue Ann Bowling and Dr. Carl Benson, UA Geophysical Institute

Figure 3
GASOLINE CONSUMPTION
In Thousands of Gallons
Fairbanks North Star Borough
1970 - 1975



Source: Dr. Sue Ann Bowling and Dr. Carl Benson, UA Geophysical Institute

Table 3
GASOLINE CONSUMPTION
In Thousands of Gallons
Fairbanks North Star Borough
1970 - 1975

	1970	1971	1972	1973	1974	1975
January	1,183	1,239	1,218	1,092	1,295	1,468
February	1,016	938	1,118	760	1,263	1,565
March	1,216	1,147	1,242	1,180	1,158	2,001
April	1,307	1,192	1,188	1,243	1,329	2,289
May	1,253	1,177	1,184	1,414	1,493	2,370
June	1,667	1,496	1,513	1,407	1,690	2,979
July	1,736	1,652	1,816	1,762	1,859	3,234
August	1,616	1,715	2,097	1,642	2,021	3,284
September	1,657	1,738	1,795	1,735	1,800	3,235
October	1,291	1,295	1,388	1,357	1,548	3,230
November	1,053	1,183	1,210	1,417	1,519	3,167
December	1,171	1,312	1,265	1,485	1,416	2,590
Total	16,167	16,084	17,095	16,976	18,391	31,406
Monthly Ave.	1,347	1,340	1,425	1,415	1,533	2,617

Source: Dr. Sue Ann Bowling and Dr. Carl Benson, UA Geophysical Institute

Figure 4
COAL CONSUMPTION
In Thousands of Tons
Fairbanks North Star Borough
1967 - 1975

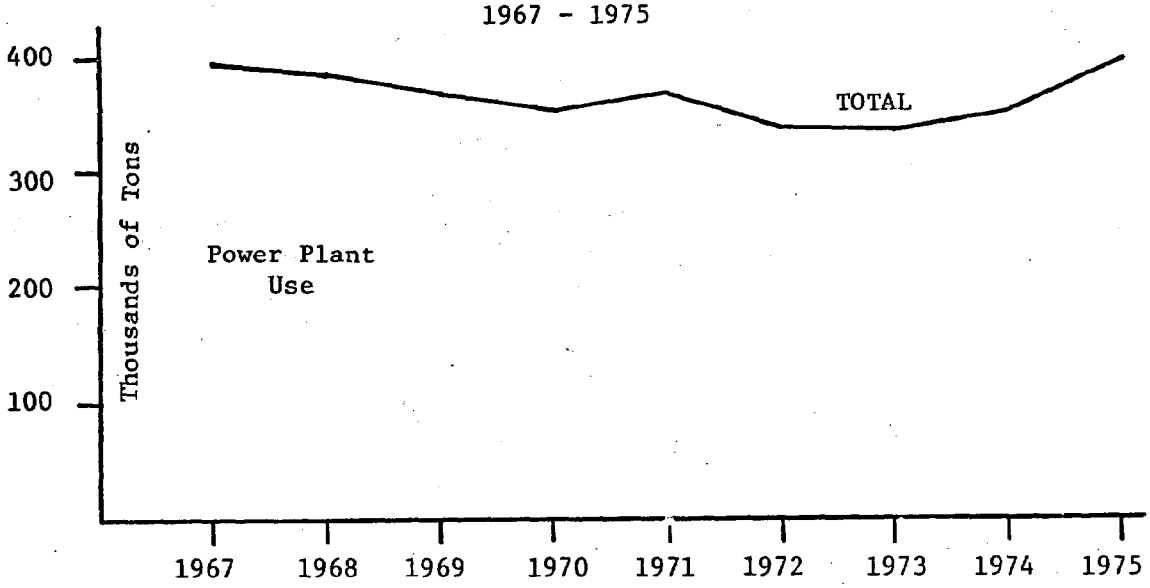


Table 4
COAL CONSUMED TO GENERATE ELECTRIC POWER
Fairbanks North Star Borough
1975

	In Thousands of Tons			
	MUS	University of Alaska	Ft. Wainwright	Total
January	13.1	4.4	27.6	45.1
February	11.4	3.7	24.7	39.9
March	11.9	3.5	21.6	37.0
April	10.0	2.6	16.0	28.7
May	9.5	1.8	14.8	26.2
June	9.2	1.5	11.6	22.3
July	8.9	1.4	9.2	19.5
August	8.5	1.4	10.4	20.3
September	9.1	3.4	13.9	26.4
October	11.1	4.1	14.3	29.6
November	13.7	4.0	21.1	38.8
December	15.7	4.2	25.3	45.1
Total	132.3	36.0	210.6	378.9

Source: Dr. Sue Ann Bowling and Dr. Carl Benson, US Geophysical Institute

Electricity Imported from Healy

Electricity is imported to Fairbanks from GVEA's power plant adjacent to the coal mine at Healy. A summary of kilowatt hours (kwh) of electricity imported from Healy since the plant opened in February 1968 are given in Table 5. The amount of electricity imported from Healy increased 39 percent from 140 million kwh in 1970 to 194 million kwh in 1974. By 1975, increased demand for GVEA's electricity kept the Healy plant operating near capacity the entire year, thus keeping the amount of electricity imported from Healy constant. The potential for building another power plant at Healy and increasing the amount of electricity imported will be discussed in Chapter

Table 5
ELECTRICITY TRANSMITTED TO FAIRBANKS
FROM GVEA HEALY POWER PLANT
1968 - 1975

	1968	1969	1970	1971	1972	1973	1974	1975
Jan.	0	6.4	16.3	16.2	17.0	17.3	17.3	18.6
Feb.	4.2	6.3	12.6	15.4	11.3	15.1	16.2	16.8
Mar.	6.6	6.2	13.0	16.9	14.4	9.8	16.4	18.4
Apr.	6.2	5.8	11.0	14.2	15.9	14.8	12.3	17.1
May	3.2	7.7	8.9	11.1	10.2	14.1	15.4	11.5
June	7.6	6.5	5.2	0	11.2	12.1	14.4	15.5
July	7.1	6.5	9.7	9.0	11.4	13.0	13.9	16.1
Aug.	3.9	7.2	10.6	12.3	13.6	13.8	14.7	14.7
Sept.	4.4	7.8	11.9	11.6	9.4	10.0	10.5	11.5
Oct.	6.0	9.6	13.3	15.0	15.6	12.6	17.8	17.6
Nov.	0.7	12.9	12.2	16.1	16.1	16.7	18.0	17.7
Dec.	8.4	14.6	15.3	14.6	15.0	17.1	17.3	18.0
Total	58	97	140	153	161	181	194	194

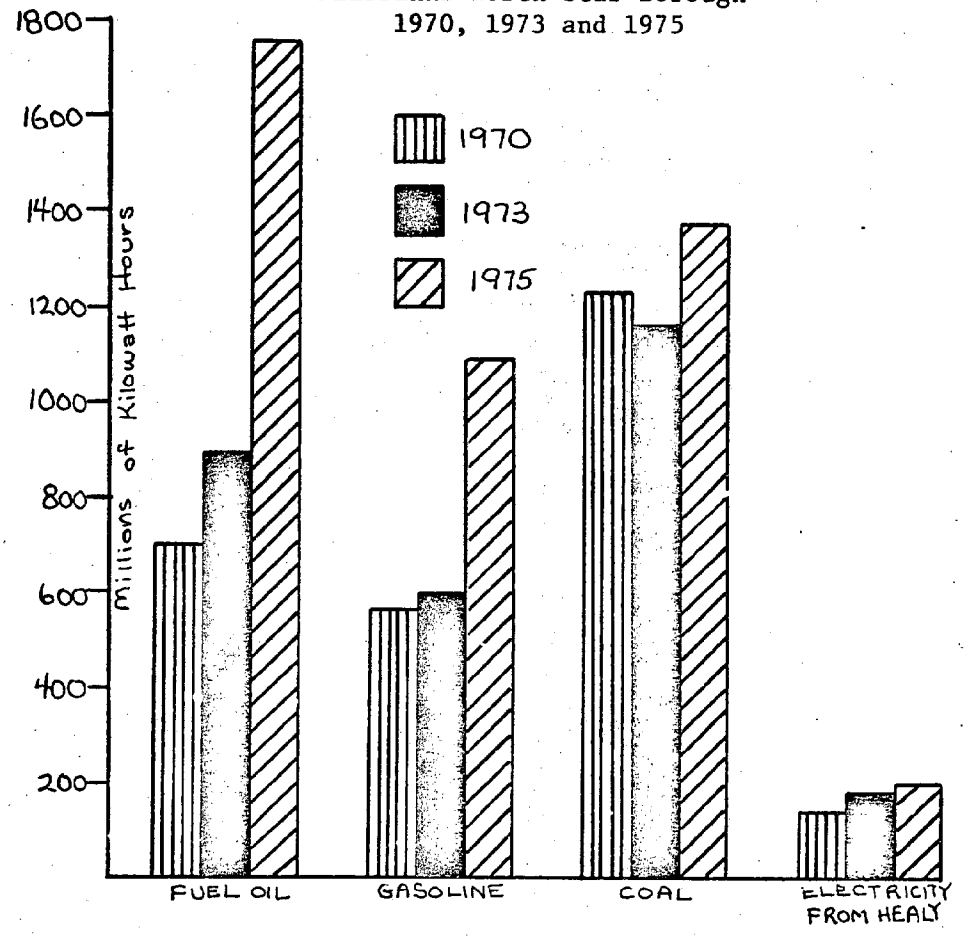
Source: Dr. Sue Ann Bowling nad Dr. Carl Benson, UA Geophysical Institute

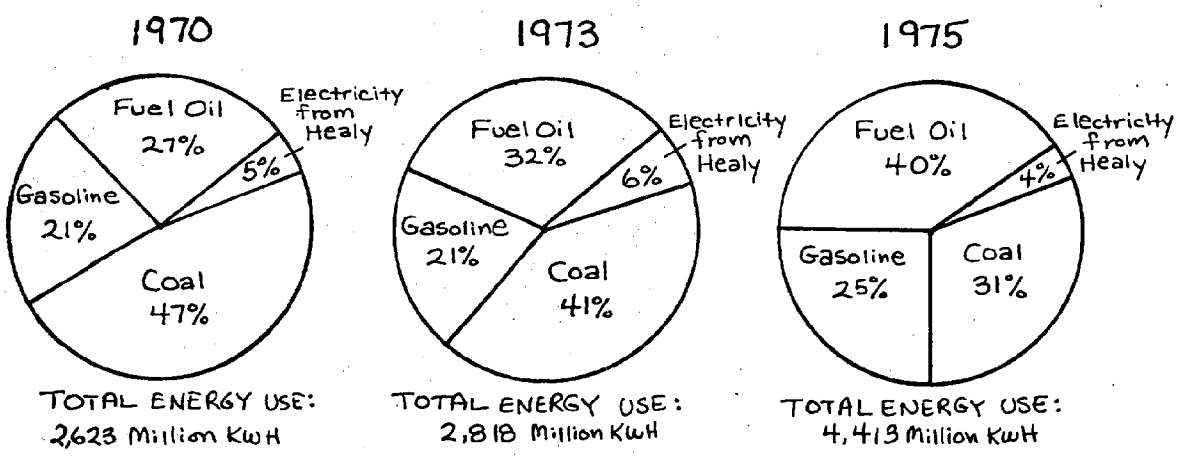
Total Energy Consumption

To compute total energy use Bowling and Benson converted the consumption of fuel oil, gasoline, coal and imported electricity into kilowatt hours. Table 6 summarizes total energy in millions of kilowatt hours for the Fairbanks North Star Borough for 1970, 1973 and 1975. It shows that energy consumption is related to temperature variations. Energy consumption in Fairbanks during the coldest winter months is roughly twice as high as consumption during the summer.

Bowling and Benson found that total energy use rose from 2.6 billion kilowatt hours in 1970 to 4.4 billion kilowatt hours in 1975, an increase of 68 percent. They also found that since 1970 there have been significant changes in the sources of energy in Fairbanks. In 1970, 47 percent of the total energy consumption in Fairbanks was generated by coal, but by 1975 coal had dropped to 31 percent of energy used. The decreasing dependence upon coal was accompanied by a corresponding increase in fuel oil consumption, from 27 percent of the total energy use in 1970 to 40 percent in 1975. The proportion of gasoline increased from 21 percent of total energy use in 1970 to 24 percent in 1975. The amount of electricity imported from Healy decreased slightly from 5 percent of the total energy consumed in 1970 to 4 percent in 1975.

Figure 5
TOTAL ENERGY USE
In Millions of Kilowatt Hours
Fairbanks North Star Borough
1970, 1973 and 1975





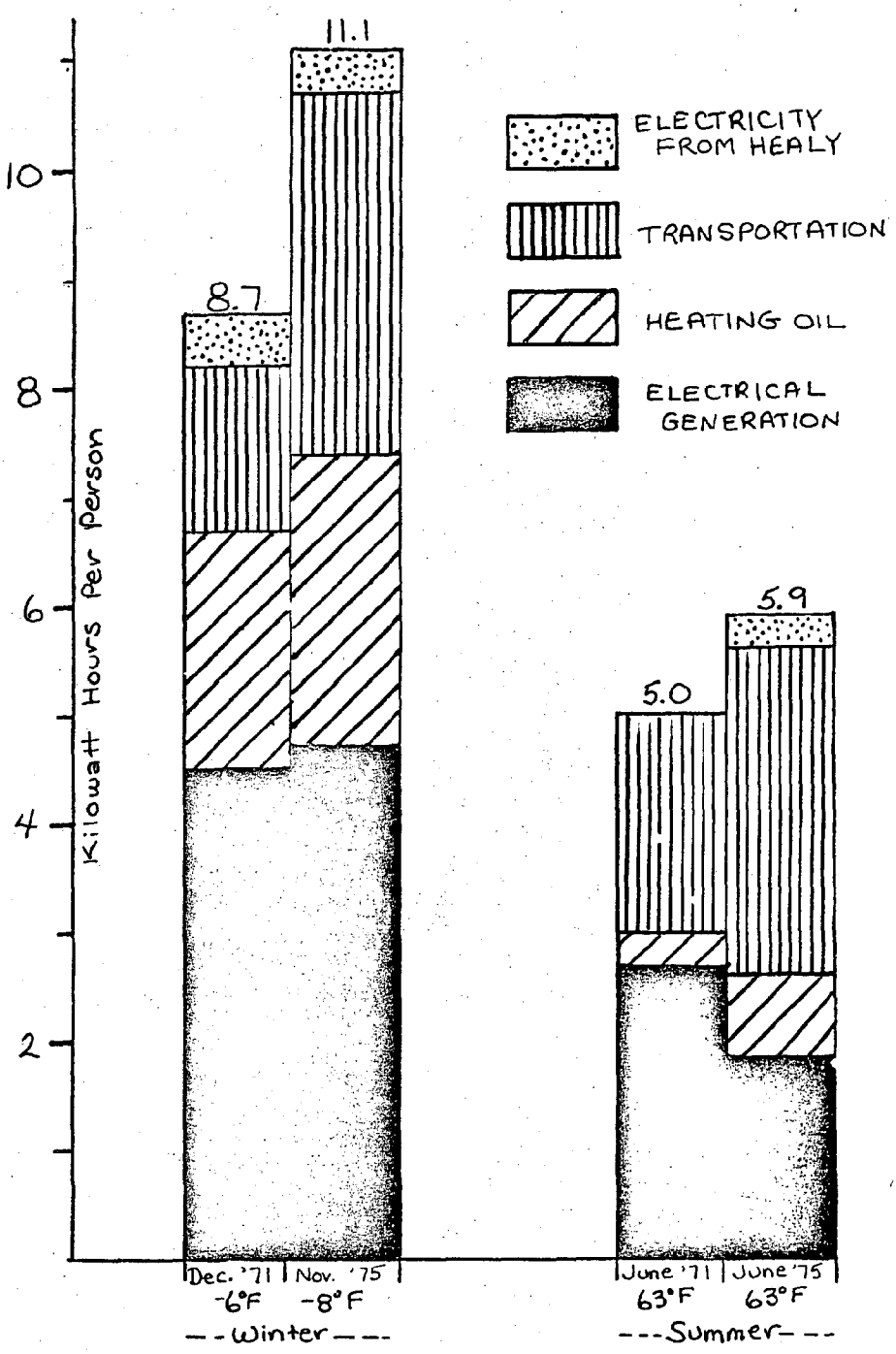
Source: Dr. Sue Ann Bowling and Dr. Carl Benson, UA Geophysical Institute

Table 6
TOTAL ENERGY USE
In Millions of Kilowatt Hours
1970, 1973 and 1975

	Fuel Oil	Gasoline	Coal	Electricity From Healy	Total	Average Temperature °F
1970						
Jan.	80	41	43	16	180	-16
Feb.	68	35	110	13	226	8
Mar.	56	42	106	13	217	21
Apr.	64	45	95	11	215	32
May	38	44	89	9	180	52
June	44	58	72	5	179	58
July	36	60	65	10	171	63
Aug.	46	56	69	11	182	57
Sept.	56	58	85	12	211	41
Oct.	52	45	109	13	219	19
Nov.	64	37	119	12	232	10
Dec.	94	41	160	15	310	-9
Total	696	563	1,224	140	2,623	28
1973						
Jan.	149	38	137	17	341	-18
Feb.	94	26	113	15	248	-2
Mar.	59	41	117	10	227	12
Apr.	43	43	92	15	193	35
May	38	49	75	14	176	50
June	30	49	61	12	152	60
July	40	61	58	13	172	63
Aug.	48	57	67	14	186	55
Sept.	57	60	86	10	213	47
Oct.	80	47	105	13	245	25
Nov.	104	49	120	17	290	0
Dec.	119	52	129	17	317	-3
Total	886	591	1,160	181	2,818	27
1975						
Jan.	216	51	163	19	449	-15
Feb.	161	54	145	17	377	-4
Mar.	151	70	135	18	374	12
Apr.	122	80	104	17	323	30
May	84	82	95	12	273	54
June	74	104	82	16	276	63
July	64	113	71	16	264	68
Aug.	94	114	74	15	297	55
Sept.	131	113	96	12	352	46
Oct.	171	112	107	18	408	24
Nov.	251	110	140	18	519	-8
Dec.	229	90	164	18	501	-16
Total	1,748	1,093	1,378	194	4,413	26

Source: Dr. Sue Ann Bowling and Dr. Carl Benson, UA Geophysical Institute

PER CAPITA ENERGY USE - IN KILOWATTS
Fairbanks North Star Borough
1971 and 1975



Source: Dr. Sue Ann Bowling and Dr. Carl Benson, UA Geophysical Institute.

Chapter II

TRANSPORTATION RELATED ENERGY CONSUMPTION

Increases in transportation activities, much of which were associated with pipeline construction, have been the primary reason for increased energy consumption in Fairbanks in the past few years. Both the need to transport materials for the pipeline and the accelerated demand for personal transportation as a result of population growth have contributed to the increased highway and air traffic.

Ground Transportation

The number of vehicles on roads and highways in the Fairbanks area increased steadily during the pipeline construction period, as shown in Table 8 and Figure 7. While most of this growth in numbers of vehicles may be attributed to population growth, there is some evidence which suggests that there were more cars and trucks per person during the pipeline construction period than previously. This may be attributed to company-owned vehicles, including the Alyeska fleet, and to greater affluence which enabled families to purchase more than one vehicle. These ratios are given in Table 7 below.

Table 7
POPULATION AND VEHICLE REGISTRATIONS
Fairbanks North Star Borough
1970, 1973 and 1976

	1970	1973	1976
Estimated Total Population	45,000	50,000	65,000
Total Vehicles	25,873	32,609	46,134
Vehicles per person	.57	.65	.71
Passenger Cars	12,750	15,708	21,752
Vehicles per person	.28	.31	.33
Cars as percent of total vehicles	49%	48%	46%
Pick-up Trucks	5,506	8,123	12,425
Pick-ups per person	.12	.16	.19
Pick-ups as percent of total vehicles	21%	25%	27%
Passenger Cars and Pick-ups	18,258	23,831	34,177
Vehicles per person	.41	.48	.53
Cars and Pick-ups as percent of total vehicles	71%	73%	74%

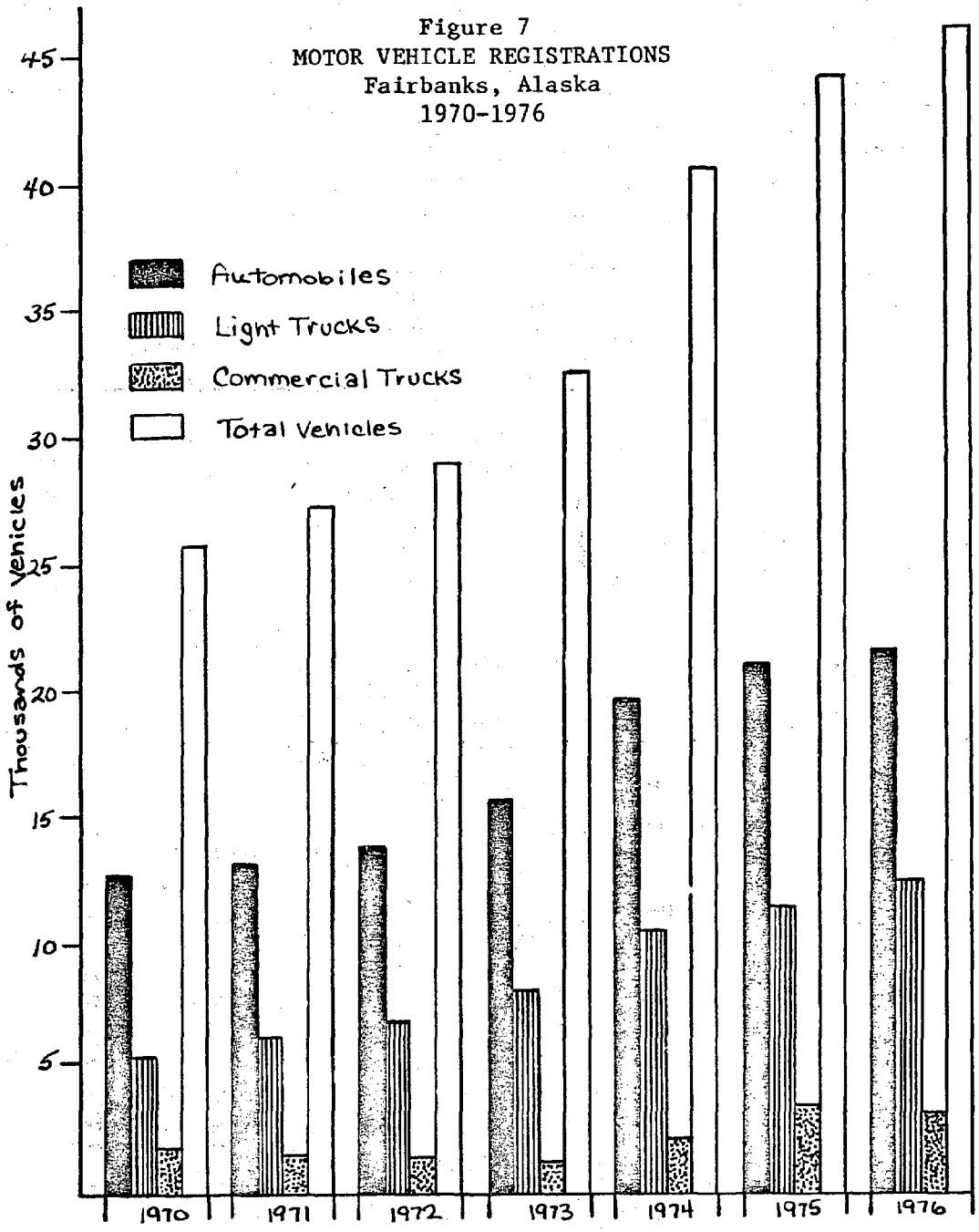
Sources: Alaska Department of Public Safety, Division of Motor Vehicles, Anchorage; Fairbanks North Star Borough, Planning and Zoning Dept.

Table 8
MOTOR VEHICLE REGISTRATIONS
Fairbanks & Anchorage
1970-1976

	1970	1971	1972	1973	1974	1975	1976	% Change 1970-1973	% Change 1973-1976
Fairbanks									
Passenger	12,752	13,214	13,851	15,708	19,695	21,075	21,752	23 %	38 %
Light Truck	5,506	6,327	6,864	8,123	10,448	11,309	12,425	48 %	53 %
Truck	1,917	1,514	1,548	1,363	2,234	3,468	3,247	-29 %	138 %
Commercial Trailer	356	384	449	438	697	1,063	1,279	23 %	192 %
Commercial Bus	67	90	86	70	61	62	119	4 %	70 %
Trailer	2,362	2,634	2,855	3,530	4,057	3,758	3,934	49 %	11 %
Motor Cycle	2,378	2,629	2,801	2,760	2,843	2,848	2,785	16 %	1 %
For Hire	37	40	48	44	58	110	76	19 %	73 %
Other	498	449	544	573	562	583	517	15 %	- 10 %
TOTAL	25,873	27,354	29,046	32,609	40,655	44,276	46,134	26 %	41 %
Anchorage									
Passenger	59,697	64,889	71,010	71,132	88,221	92,280	92,613	19 %	30 %
Light Truck	16,888	21,185	23,831	24,301	30,001	33,251	34,611	44 %	42 %
Truck	5,853	4,614	5,463	4,637	6,654	9,763	10,952	-21 %	136 %
Commercial Trailer	2,137	2,276	2,758	2,939	4,035	5,475	5,713	38 %	94 %
Commercial Bus	254	273	319	350	549	820	908	38 %	159 %
Trailer	11,411	12,510	13,795	14,105	16,853	16,501	15,550	24 %	10 %
Motor Cycle	4,438	5,309	5,683	5,724	6,939	6,681	6,382	29 %	11 %
For Hire	106	116	127	137	208	255	279	29 %	104 %
Other	3,938	4,383	3,160	2,789	2,982	1,499	3,958	-29 %	42 %
TOTAL	104,722	115,555	126,146	126,114	156,442	166,525	170,966	20 %	36 %

Source: Alaska Department of Public Safety, Division of Motor Vehicles, Anchorage.

Figure 7
MOTOR VEHICLE REGISTRATIONS
Fairbanks, Alaska
1970-1976

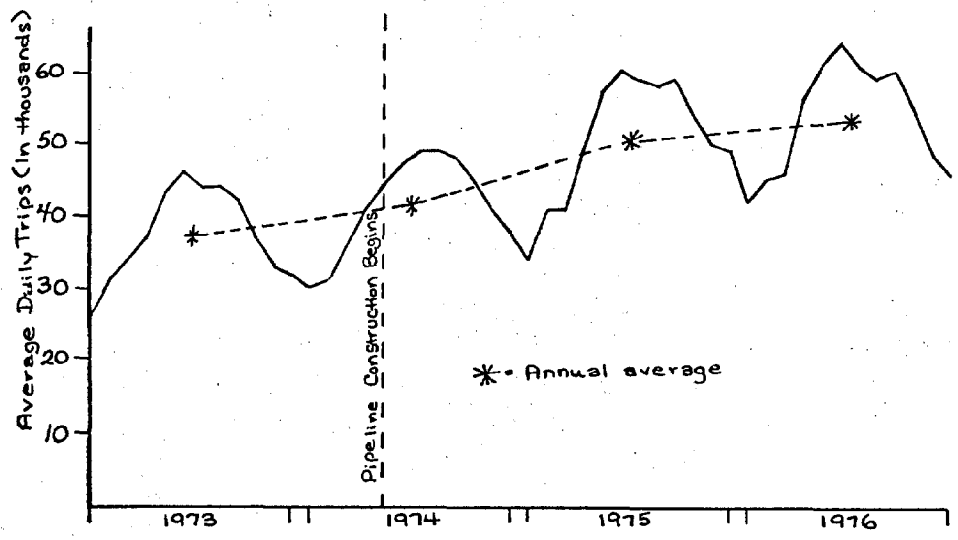


Source: Alaska Department of Public Safety, Division of Motor Vehicles, Anchorage.

The greatest increases were in pick-up trucks, which tend to consume more gasoline per mile than passenger cars. The increase in popularity of pick-up trucks may relate to national trends, or to residential growth in outlying areas of the borough where roads are often poor and services such as refuse collection are not available, or to the practicality of having a pick-up truck as a second vehicle.

The growing number of vehicles in Fairbanks created traffic problems. Between 1973 and 1976 the number of vehicles increased 41 percent and the Alaska Department of Highways estimates that traffic in the metropolitan area increased a corresponding 43 percent. This increase is illustrated in Figure 8. The existing road system and traffic routings proved insufficient to handle the increased demand. Between 1973 and 1976 the number of auto accidents in Fairbanks increased 67 percent. A potentially negative effect of more vehicles is increased air pollution. Vehicle exhaust has been identified as the primary cause of poor air quality in the metropolitan area. This issue is discussed in greater detail in the final chapter of this report.

Figure 8
MOTOR VEHICLE TRAFFIC
Fairbanks Metropolitan Area
1973-1976



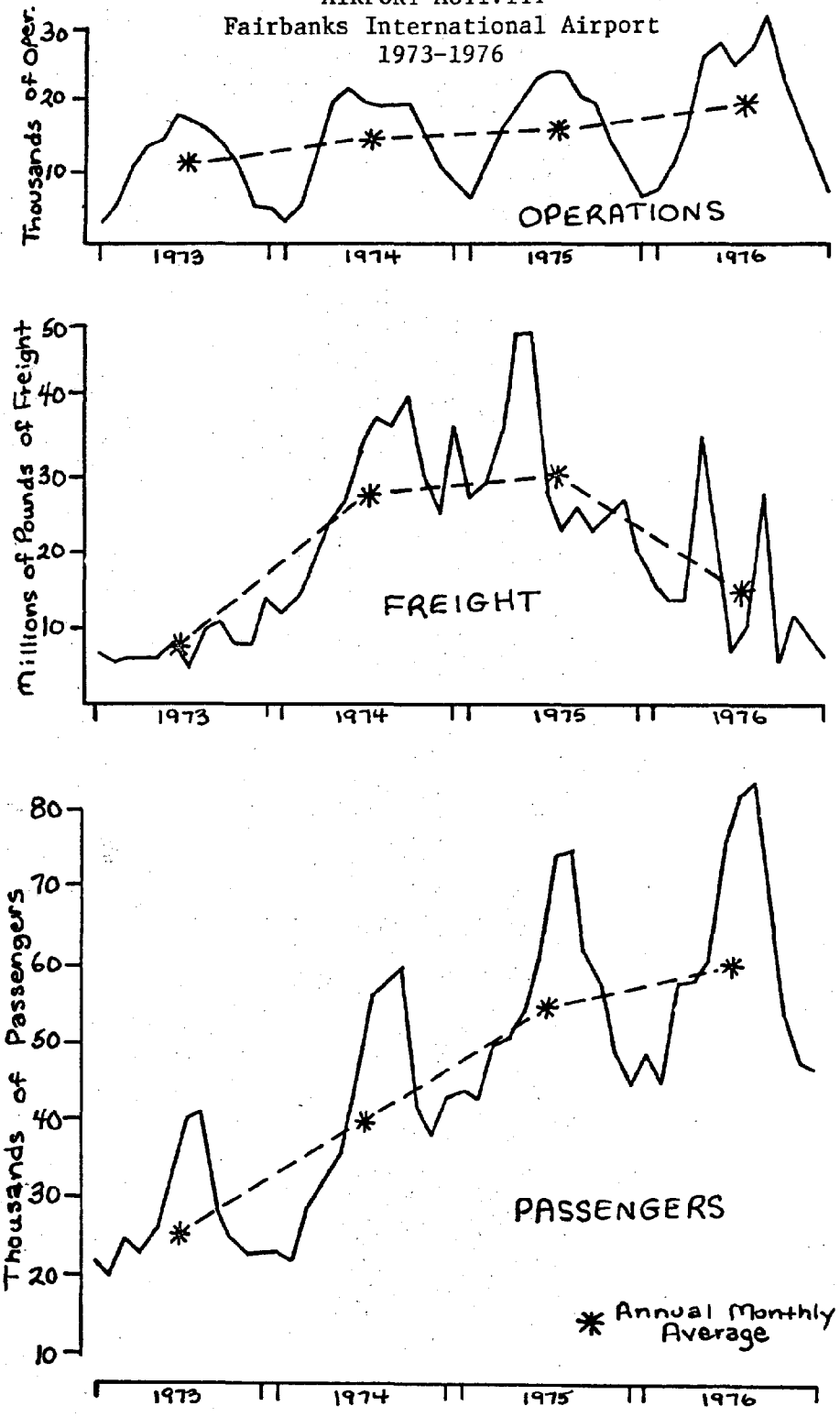
Source: Alaska Department of Highways, Fairbanks District, Traffic Planning

Table 9
AIRPORT ACTIVITY
Fairbanks International Airport
1973-1976

	1973	1974	1975	1976
Operations				
January	2,667	3,436	6,414	6,709
February	5,488	4,953	10,063	9,649
March	9,942	12,208	14,681	15,343
April	12,537	17,698	17,979	23,902
May	13,411	20,391	20,648	26,129
June	16,650	18,407	21,744	23,232
July	15,861	18,525	21,720	24,997
August	15,294	18,916	18,746	28,520
September	13,660	18,733	18,446	22,180
October	9,775	14,136	12,510	16,607
November	5,474	10,285	9,505	12,133
December	5,116	8,341	5,582	7,464
Total	125,875	166,029	178,038	216,865
Daily Average	345	455	488	594
Freight				
January	6,816,383	11,563,606	26,580,219	16,102,812
February	5,722,382	13,522,136	28,903,063	14,389,115
March	6,440,289	19,334,989	35,312,465	14,364,676
April	6,077,847	24,028,339	48,229,049	35,294,985
May	6,262,973	26,866,714	48,188,402	25,345,935
June	8,054,158	32,803,172	27,850,899	6,856,564
July	4,746,899	36,715,545	23,248,028	11,116,570
August	9,709,415	36,499,883	26,011,667	27,922,974
September	10,757,567	39,887,867	23,314,514	5,800,575
October	7,763,146	30,444,135	25,275,119	11,903,629
November	7,637,813	24,655,890	27,352,238	9,355,708
December	13,859,748	35,897,711	20,138,641	7,086,266
Total	93,848,620	332,219,987	360,404,304	185,539,809
Daily Average	257,120	910,192	987,409	508,328
Passengers				
January	22,421	23,207	42,368	48,684
February	20,454	22,405	40,880	45,460
March	24,903	29,401	50,297	57,639
April	23,358	31,779	51,261	58,274
May	26,067	35,546	53,510	60,726
June	33,325	43,814	60,803	76,236
July	40,326	54,527	74,382	82,252
August	40,937	57,778	74,650	84,099
September	29,079	59,539	61,124	65,102
October	24,965	42,047	58,216	53,707
November	22,779	38,026	49,438	47,511
December	22,929	42,830	44,933	47,243
Total	311,363	480,899	661,862	726,933
Daily Average	853	1,318	1,813	1,992

Source: Alaska Department of Public Works, Division of Aviation.

Figure 9
AIRPORT ACTIVITY
Fairbanks International Airport
1973-1976



Source: Alaska Department of Public Works, Division of Aviation.

Air Transportation

Air transportation also increased significantly in Fairbanks during the pipeline period. The number of operations (take-offs and landings) at Fairbanks International Airport increased from 125,875 in 1973 to 216,865 in 1976, a 72 percent increase. At the beginning of the pipeline project, prior to completion of the North Slope Haul Road, much of the growth in airport activities may be attributed to freight shipments from Fairbanks to the North Slope and other pipeline destinations. After the North Slope Haul Road was completed, airborne freight declined and more freight was trucked up the highway. Much of the growth in airport activities in recent years may be attributed to small, private aircraft, another sign of affluence as a result of pipeline activities. Table 9 and Figure 9 summarize airport activity.

Chapter III

ENERGY COST COMPARISONS

Introduction

In a recent survey, readers of Impact Information Center Reports ranked articles on cost of living as their number one topic of interest. However, data on cost of living for Fairbanks and most communities in Alaska is minimal. Prior to 1970 the Bureau of Labor Statistics (BLS) computed a Consumer Price Index (CPI) for Fairbanks, but at the present time Anchorage is the only city in Alaska which has a CPI. In 1976 Congress approved legislation which required BLS to re-establish a CPI for Fairbanks. However, consumer expenditure surveys to establish baseline data will not be completed until mid-1978 and it appears likely that a Fairbanks CPI will not begin until 1979.

Due largely to the lack of other data, cost of living comparisons between Alaska cities commonly are limited to differences in food prices or at best a combination of housing and food costs. Such surveys have frequently concluded that Fairbanks living costs are about 15 percent higher than Anchorage. It is apparent from the data in this chapter that energy cost differentials are greater than 15 percent.

The price information which follows will be put into clearer perspective in Chapter IV when it is applied to comparisons of home heating costs.

Heating Oil

As noted in Chapter I, heating fuel is by far the most common type used in Fairbanks. Most residents use #1 fuel because it flows better during the extreme low temperatures. Heating oil prices vary seasonally. They are lowest in the summer months when sales decline and usually increase in the fall and winter months in response to greater demand. Since most consumers buy the bulk of their fuel during the winter months, the Impact Center's survey of distributors was conducted in October and November. Prices surveyed are for a phone order, cash payment, delivered to a residence.

A summary of prices charged by Fairbanks heating oil distributors from 1974 to 1976 is summarized in Table 10. It shows that those who purchase fuel in small quantities pay a higher price per gallon than those who purchase 500 or more gallons. In 1974 the price of #1 heating oil ranged from a low of 45.4¢ per gallon (based on the 500 gallon rate) to a high of 51.2¢ per gallon. By fall 1976 these prices had increased an average 20 to 25 percent and ranged from 56.9¢ to 61.5¢ per gallon.

Table 10
HEATING OIL PRICES* PER GALLON
Fairbanks, Alaska
1974, 1975 and 1976

Company	Oil Type	100 Gallon			300 Gallon			500 Gallon			% Increase 500 Gal. 1974-1976	% Increase 500 Gal. 1975-1976
		1974	1975	1976	1974	1975	1976	1974	1975	1976		
Chevron												
Fbks. Fuel Supply	#1	49.9¢	56.4¢	61.9¢	48.4¢	54.9¢	60.4¢	47.4¢	53.9¢	59.4¢	25%	10%
	#2	49.9	55.9	60.4	48.4	54.4	58.9	47.4	53.4	57.9	22%	8%
Sourdough Heating	#1	49.9	56.4	62.9	48.4	54.9	59.4	47.4	53.9	58.4	23%	8%
	#2	49.9	55.9	61.4	48.4	54.4	57.9	47.4	53.4	56.9	20%	7%
Union												
Johnny's Express	#1	46.4	54.2	57.7	45.9	53.7	57.7	45.9	53.7	57.2	25%	7%
	#2	45.1	52.9	56.4	44.2	52.0	56.4	44.2	52.0	55.5	26%	7%
Petroleum Sales	#1	NA	NA	NA	52.2	59.0	63.5	51.2	58.0	61.5	20%	6%
	#2	NA	NA	NA	46.9	53.7	58.2	45.9	52.7	56.2	22%	7%
Tesoro												
Kobuk Oil Co.	#1	49.5	59.0	66.9	46.4	55.9	60.9	45.4	54.9	59.9	32%	9%
	#2	NA	57.8	65.9	NA	54.7	59.9	NA	53.7	58.9	-	10%
Shell Oil												
Northern Gas & Oil	#1	61.9	61.9	65.1	58.0	58.4	60.6	55.0	55.4	57.6	5%	4%
	#2	60.4	60.5	63.7	56.5	57.0	59.2	53.5	54.0	56.2	5%	4%
Texaco												
Peters Express	#1	53.5	62.0	66.0	50.5	57.5	59.5	48.9	55.9	56.9	16%	2%
	#2	52.5	60.0	64.0	49.5	55.5	61.5	47.9	53.9	58.9	23%	9%
Northern Heating	#1	53.4	61.4	65.9	51.9	59.9	59.9	50.9	58.9	58.9	16%	0
	#2	49.4	59.4	64.9	47.9	55.9	58.9	46.9	54.9	57.9	23%	5%

*Based on phone order, cash payment, delivered fuel for October 1974, October 1975 and November 1976.

Source: Compiled by the Impact Information Center from information supplied by each distributor.

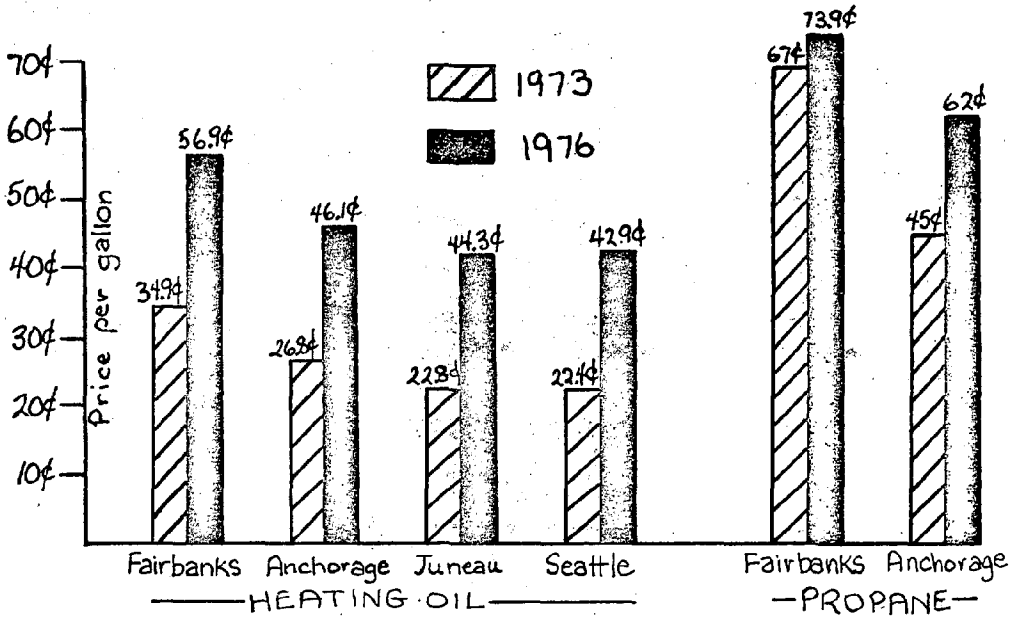
Table 11
HEATING OIL PRICES* PER GALLON
Fairbanks, Anchorage and Seattle
November 1976

	Oil Type	100 Gallon	300 Gallon	500 Gallon
Fairbanks				
Chevron				
Fairbanks Fuel Supply	#1	61.9¢	60.4¢	59.4¢
	#2	60.4	58.9	57.9
Sourdough Heating	#1	62.9	59.4	58.4
	#2	61.4	57.9	56.9
Union				
Johnny's Express	#1	57.7	57.7	57.2
	#2	56.4	56.4	55.5
Petroleum Sales	#1	NA	63.5	61.5
	#2	NA	58.2	56.2
Tesoro				
Kobuk Oil Co.	#1	66.9	60.9	59.9
	#2	65.9	59.9	58.9
Shell Oil				
Northern Gas & Oil	#1	65.1	60.6	57.6
	#2	63.7	59.2	56.2
Texaco				
Peters Express	#1	66.0	59.5	56.9
	#2	64.0	61.5	58.9
Northern Heating	#1	65.9	59.9	58.9
	#2	64.9	58.9	57.9
Anchorage				
Alaska Heat Inc.	#1	49.5¢	48.5¢	48.5¢
	#2	47.5	46.5	46.5
Union				
Katmai Oil & Gas	#1	NA	47.0	47.0
	#2	NA	46.0	46.0
Texaco				
Denali Fuel Co.	#1	48.7	47.7	47.7
	#2	47.1	46.1	46.1
Shell				
Northern Gas & Oil Co.	#1	NA	48.0	48.0
	#2	NA	46.0	46.0
Tesoro				
Petro Products, Inc.	#1	47.0	47.0	47.0
	#2	45.9	45.9	45.9
Chevron				
Consolidated Fuel Co.	#1	48.7	47.7	47.7
	#2	47.1	46.1	46.1
Seattle				
Union				
Pacific Coast Hemphill Oil Co.	#1	46.9	44.9	43.9
	#2	45.9	43.9	42.9
Shell				
Universal Oil Delivery Inc.	#1	NA	NA	NA
	#2	47.9	43.9	42.9

*Based on phone order, cash payment, delivered.

Source: Impact Information Center Survey of heating oil distributors.

Figure 11
HEATING OIL AND PROPANE PRICES* PER GALLON
Fairbanks, Anchorage, Juneau and Seattle
Fall 1973 and Fall 1976



*More than one distributor was surveyed in each city. The above prices represent the middle range of those quoted. Prices are based on a minimum of 500 gallons delivered.

Sources: Heating Oil - Sourdough Heating (Fairbanks), Consolidated Fuel Company (Anchorage), Chilkat Fuel Company, Inc. (Juneau), and Pacific Coast Hemphill (Seattle). Propane - Petrolane Gas Service (Fairbanks) and Northern Gas (Anchorage).

Table 12
PROPANE PRICES PER GALLON
Fairbanks and Anchorage
Fall 1976
Propane Costs

Fairbanks			Anchorage		
Petrolane Gas Service			**Petrolane Gas Service**		
Heating:	100 lbs.	$1.14/gal.	Heating:	100 lbs.	91¢/gal.
	100 gal.	73.9¢/gal.		100 gal.	79¢/gal.
Vangass Inc.			**Northern Gas**		
Cooking:	100 lbs.	98.5¢/gal.	Cooking:	100 lbs.	85¢/gal.
				100 gal.	75¢/gal.
Heating:	50 gal.	$1.05/gal.			
	100 gal.	$1.00/gal.	Heating:	100 lbs.	77¢/gal.
	lg. quant.	63.5¢/gal.		100 gal.	62¢/gal.

Table 11 shows that fall 1976 heating oil prices were roughly 19 to 25 percent higher in Fairbanks than Anchorage and 30 to 45 percent higher than Seattle. Although Fairbanks heating oil prices are higher, Figure 11 illustrates that price increases between 1973 and 1976 were not unique to Fairbanks. The price of heating fuel in Seattle went from 22.4¢ per gallon in 1973 to 42.9¢ per gallon in 1976, an increase of 92 percent. Anchorage heating oil prices rose from 26.8¢ per gallon in 1973 to 46.1¢ in 1976, a 72 percent increase. Fairbanks heating oil prices between 1973 and 1976 increased 63 percent from 34.9¢ to 56.9¢.

Propane

Although propane is available in Fairbanks, its use is minimal in comparison to other fuel sources. Most of the propane sold in Fairbanks is used only for cooking. Persons living in areas without electricity sometimes also use it for lighting. In 1973 propane was 67¢ per gallon compared to 73.9¢ per gallon in 1976, an increase of 10 percent. However, propane is very expensive in comparison to other energy sources as will be demonstrated in the home heating cost comparisons in Chapter IV.

Electricity

As Figure 12 illustrates, electricity costs in Fairbanks increased dramatically between 1973 and 1976. The charge for 1,000 kwh for city residents served by the Municipal Utilities System (MUS) increased from $45 in 1973 to $57 in 1976, a 27 percent increase. In the same period, the cost of 1,000 kwh of electricity for GVEA members living outside the city increased from aout $49 to $64, a 31 percent jump. Figure 11 also shows that electrical rates in Fairbanks were exceptionally high in comparison to those paid in Anchorage, Juneau and Seattle. In 1976 1,000 kwh of electricity was $64 in Fairbanks, $26 in Anchorage, $42 in Juneau and only about $10 in Seattle.

All of the Alaska utilities surveyed had preferential rates for customers who used larger amounts of electricity. In Anchorage customers who purchased over 1,500 kwh per month in 1976 paid only 1.6¢ per kwh while those who purchased less than 50 kwh paid 7¢ per kwh. In Fairbanks GVEA charged 10¢ per kwh for members using up to 100 kwh, but 3.75¢ per kwh for members using over 1,200 kwh. In contrast to the Alaska practice, the rate structure of Seattle Light and Power Company provided an incentive to conserve electricity. Customers using 480 kwh or less were charged .78¢ per kwh, while those using over 2,500 kwh were charged 1.2¢ per kwh.

Natural Gas

Although the community does not presently have natural gas, if the

Table 13
ELECTRICAL RATES
Fairbanks, Anchorage, Juneau and Seattle
Fall 1973 and Fall 1976

Fairbanks - Municipal Utilities System

1973		1976	
Minimum	$4/month	0 to 50 kwh	$4.75/month
0 to 50 kwh	9.2¢/kwh	up to 100 kwh	9.5¢/kwh
up to 100 kwh	8¢/kwh	next 300 kwh	6¢/kwh
next 150 kwh	5.75¢/kwh	next 600 kwh	4.5¢/kwh
over 250 kwh	3.45¢/kwh	next 1,000 kwh	4¢/kwh
sales tax	5%	sales tax	5%
Cost of 1,000 kwh	$43.10	Cost of 1,000 kwh	$54.50
+ sales tax	2.16	+ sales tax	2.73
Total bill	$45.26	Total bill	$57.23

Fairbanks - Golden Valley Electric Association

1973			1976		
	Within City	Outside City		Within City	Outside City
Minimum	$10/month	$10/month	0 to 100 kwh	10¢/kwh	10¢/kwh
1st 150 kwh	8¢/kwh	8¢/kwh	next 400 kwh	6.5¢/kwh	7¢/kwh
next 550 kwh	3.9¢/kwh	5.25¢/kwh	next 700 kwh	4.5¢/kwh	5¢/kw
next 800 kwh	2.2¢/kwh	2.25¢/kwh	over 1,200 kwh	3.75¢/kwh	3.75¢/kwh
over 1,500 kwh	1.85¢/kwh	1.85¢/kwh	sales tax	5%	2%
sales tax	5%	2%			
Cost of 1,000 kwh	$40.05	$47.63	Cost of 1,000 kwh	$58.50	$63.00
+ sales tax	2.00	.95	+ sales tax	2.93	1.26
Total bill	$42.05	$48.58	Total bill	$61.43	$64.26

Anchorage - Chugach Electric Association

1973			1976		
	Within City	Outside City		Within City	Outside City
1st 50 kwh	5.5¢/kwh	6.4¢/kwh	1st 50 kwh	7¢/kwh	7¢/kwh
next 200 kwh	3.0¢/kwh	3.7¢/kwh	next 200 kwh	3.5¢/kwh	4.3¢/kwh
next 500 kwh	2.0¢/kwh	2.6¢/kwh	next 500 kwh	2.2¢/kwh	3.2¢/kwh
next 750 kwh	1.8¢/kwh	1.6¢/kwh	next 750 kwh	1.9¢/kwh	1.9¢/kwh
over 1,500 kwh	1.4¢/kwh	1.4¢/kwh	over 1,500 kwh	1.6¢/kwh	1.6¢/kwh
Cost of 1,000 kwh	$22.75	$27.60	Cost of 1,000 kwh	$26.25	$32.85

Juneau - Alaska Electric Light & Power Co.

1973	Within City	Outside City
1st 180 kwh	5¢/kwh	5¢/kwh
over 180 kwh	2.8¢/kwh	2.8¢/kwh
sales tax	3%	1%
Cost of 1,000 kwh	$31.96	$31.96
+ sales tax	.96	.32
Total bill	$32.92	$32.28

1976	Within City	Outside City
1st 180 kwh	5.8¢/kwh	5.8¢/kwh
over 180 kwh	3.6¢/kwh	3.6¢/kwh
sales tax	3%	1%
surcharge	3%	
Cost of 1,000 kwh	$39.96	$39.96
+ sales tax	1.20	.40
+ surcharge	1.20	
Total bill	$42.36	$40.36

Seattle - City Light

1973	
1st 525 kwh or less/month	$5.25*
next 975 kwh	.74¢/kwh
next 1,000 kwh	.80¢/kwh
over 2,500 kwh	.90¢/kwh
Cost of 1,000 kwh	$8.77

*minimum charge of $5.25 was charged instead of meter charge

1976	
1st 480 kwh	.78¢/kwh
next 720 kwh	.86¢/kwh
next 1,300 kwh	.91¢/kwh
over 2,500 kwh	1.2¢/kwh
meter charge	$1.50/month
Cost of 1,000 kwh	$8.22
+ meter charge	1.50
Total bill	$9.72

Table 14
NATURAL GAS RATES
Anchorage and Seattle
Fall 1973 and Fall 1976

Anchorage - Alaska Gas & Service Co.

1973	
$4 minimum/month	
0-19 ccf*	$4
next 31 ccf	20¢/ccf
additional ccf	12¢/ccf

1976	
$4 minimum/month	
0-19 ccf	$4
next 31 ccf	20¢/ccf
additional ccf	12¢/ccf
plus .02681% to cover five rate increases since 1974	

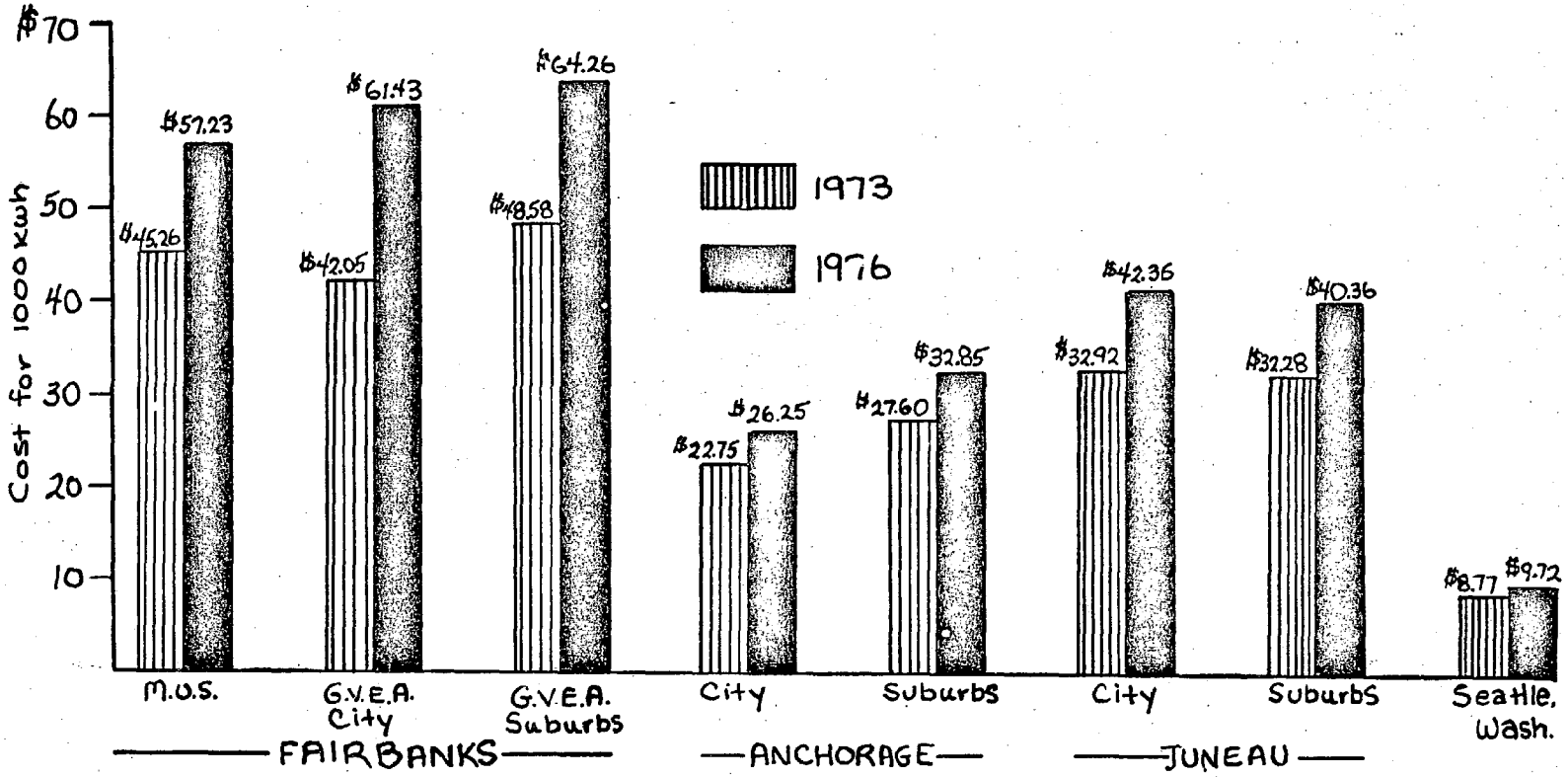
Seattle - Washington Natural Gas Co.

1973	
0-5 therms*	$1.5155
next 5 therms	25.71¢/therm
next 10 therms	20.31¢/therm
next 30 therms	17.21¢/therm
next 50 therms	13.31¢/therm
over 100 therms	12.51¢/therm
+ city tax	.0753%

1976	
0-5 therms	$2.16
next 15 therms	34.35¢/therm
next 30 therms	29.47¢/therm
next 50 therms	25.47¢/therm
additional therms	24.68¢/therm
+ city tax	.0753%

*ccf = 100 cubic feet of natural gas and is approximately equivalent to a therm.

Figure 12
COST COMPARISONS FOR 1,000 KWH OF ELECTRICITY
Fairbanks, Anchorage, Juneau and Seattle
Fall 1973 and Fall 1976



Sources: Fairbanks Municipal Utilities System, Golden Valley Electric Association (Fairbanks), Chugach Electric Association (Anchorage), Alaska Electric Light and Power Company (Juneau), and Seattle City Light.

proposed gas pipeline is routed through Fairbanks, it may provide the opportunity for local utilization. Rates charged by gas companies in Seattle and Anchorage are given in Table 14. Readers unfamiliar with gas prices will probably not find these figures very meaningful. However, the relative cost of gas to other fuels is demonstrated in the home heating comparisons in Chapter IV.

Coal

Although the price of coal has nearly doubled from $18 per ton in 1973 to $30.50 per ton in 1976, it continues to be the cheapest and most abundant fossil fuel resource in the Fairbanks area. As noted in Chapter I, nearly all of the coal brought to Fairbanks is used to generate electric power.

Future Trends in Energy Costs

As will be discussed in the chapter on Electrical Utilities, it is difficult to predict the source of future energy costs. Many of the developments which influence these costs are determined by international economic and political events which are often unpredictable. At the present time there are a number of factors, such as the proposed gas pipeline, which could potentially lower energy costs in Fairbanks. It is anticipated that the North Pole Refinery scheduled for completion in fall 1977 will significantly lower the cost of heating oil. There have also been discussions for many years about hydroelectric power projects. As will be covered in Chapter V, MUS and GVEA are considering construction of a coal-fired power plant at Healy.

Due to the increasing demand for energy, there have been major efforts to develop new sources. A number of Alaskan researchers are exploring some of these approaches which include solar energy, geothermal energy and wind power. However, in spite of these developments, most energy experts concur that it will be difficult to meet the accelerating demands for energy. There is widespread recognition among energy experts that the days of cheap, abundant energy from fossil fuels are over - here, and everywhere.

Table 15
COAL COSTS
Usibelli Coal Mines, Inc. - Fairbanks
1973 and 1976

	1973	1976
Coal		
Stoker coal	$16.45/ton	$29.25/ton
Lump coal	18.00/ton	30.50/ton
Delivery		
1 ton	$8.15/ton	$22/ton
2 tons	7.05/ton	15/ton
3 tons	6.80/ton	14/ton
4 tons	6.55/ton	13/ton
5 tons	6.55/ton	12/ton
Per mile out of town	50¢/mile	$1.05/mile
Tax		
Delivered within city	5%	5%
Delivered outside city	2%	2%

Cost of 13 Tons of Lump Coal - Delivered

Chapter IV

CONSUMER GUIDE TO HOME HEATING, ELECTRICITY & VEHICLE COSTS

The energy crisis and high fuel costs have caused consumers to be increasingly conscious of energy consumption. A recent survey by the National Association of Realtors found that nine out of ten prospective home buyers asked about the heating and electricity costs of the homes they were shown (Fairbanks Daily News Miner, February 26, 1977).

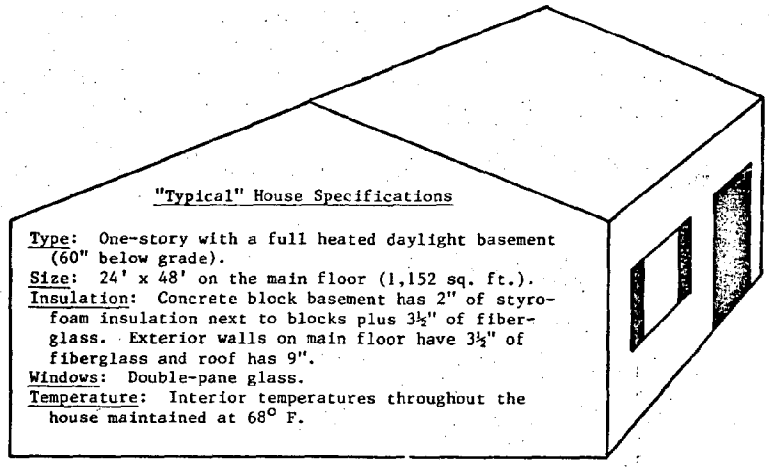
The previous chapter summarized prices for several types of energy. To compare the relative cost of these fuels, the Impact Center asked Axel Carlson, Extension Engineer with the University of Alaska's Cooperative Extension Service made computer runs for a typical home (described in Table 16) to estimate its fuel requirements for a variety of energy sources. The Impact Center computed estimates of annual heating costs for 1973 and 1976. The results, summarized in Table 16 estimated that 1976 annual heating costs for the typical home would be $580 for coal, $2,004 for electricity, $1,087 for fuel oil, $2,057 for propane and $1,010 for spruce wood. Figure 13 illustrates these costs and compares them with 1973 cost estimates.

Although coal was the least expensive fuel, as noted in Chapter I, very few Fairbanks homes use it as a heating source. Heating with coal requires coal storage and involves considerably more effort than most ofther fuels. Of the other fuels, heating oil is the most economical.

Prior to major rate increases which occurred during the past few years, electricity was an attractive heating source because it was clean, required lower installation costs and entailed less maintenance than oil systems. In April 1975 GVEA announed a moratorium on the installation of electrical heating facilities. Company officials explained that they could not handle any more electrical heat customers. Prior to the pipeline GVEA received electric heat applications from only two out of five builders. However when the pipeline related housing shortage put pressure on builders to speed up construction schedules, GVEA said nine out of ten builders were applying for electric heat.

Due to the soaring price of electricity, some homeowners are having fuel oil heating systems installed. The Impact Center contacted several local plumbers and contractors who install oil-fired hot water baseboard systems and found that the cost of coverting a home from electricity to oil would probably cost $5,000 to $7,000. One contractor estimated that such a conversion would cost 7 to 10 percent of the appraised value of the home. In a survey of homes which had osld in the Fairbanks area in 1976, the Impact Center found that homes heated with electricity were not selling as well as those with oil heat. Additionally appraisers and realtors have told the Impact Center than a home heated with electricity would likely be appraised for less than an identical home with oil heat.

Table 16
ESTIMATED ANNUAL FUEL REQUIREMENTS AND HEATING COSTS* FOR A TYPICAL HOUSE
Fairbanks, Anchorage, Juneau and Seattle
1973 and 1976



Fall 1973

Fuel	Unit	Annual Costs: Cost/ Unit	X No. of Units	= Fuel Cost	+ Delivery or Other Charges	+ Tax Rate	= Total Heating Costs	Average Monthly Heating Costs
Fairbanks - aver. annual temp. 25.6°F								
Bituminous Coal - city	ton	$18.00	13	$ 234	$6.55/ton	5%	$ 335	$ 28
Bituminous Coal - 10 miles outside city	ton	$18.00	13	234	$6.55/ton	2%	326	27
Electricity - MUS	kwh	3.45¢	52,392	1,808	-	5%	1,898	158
Electricity - GVEA	kwh	1.85¢	52,392	969	-	2%	988	82
Fuel Oil	gal.	34.9¢	1,910	667	-	-	667	56
Propane	gal.	69¢	2,783	1,920	-	-	1,920	160
Anchorage - aver. annual temp. 35°F								
Electricity	kwh	1.4¢	40,917	$ 573	-	-	$ 573	$48
Fuel Oil	gal.	26.8¢	1,492	400	-	-	400	33
Natural Gas	ccf.	12¢	1,995	239	-	-	239	20
Propane	gal.	45¢	2,173	978	-	-	978	81
Juneau - aver. annual temp. 42.8°F								
Electricity	kwh	2.8¢	31,970	$ 895	-	3%	$ 922	$ 77
Fuel Oil	gal.	22.8¢	1,166	266	-	-	266	22
Seattle - aver. annual temp. 53.2°F								
Electricity	kwh	.90¢	19,351	$ 174	-	-	$ 174	$ 14
Fuel Oil	gal.	22.4¢	706	158	-	-	158	13
Natural Gas	therms	12.51¢	944	118	-	7½%	127	11

Fall 1976

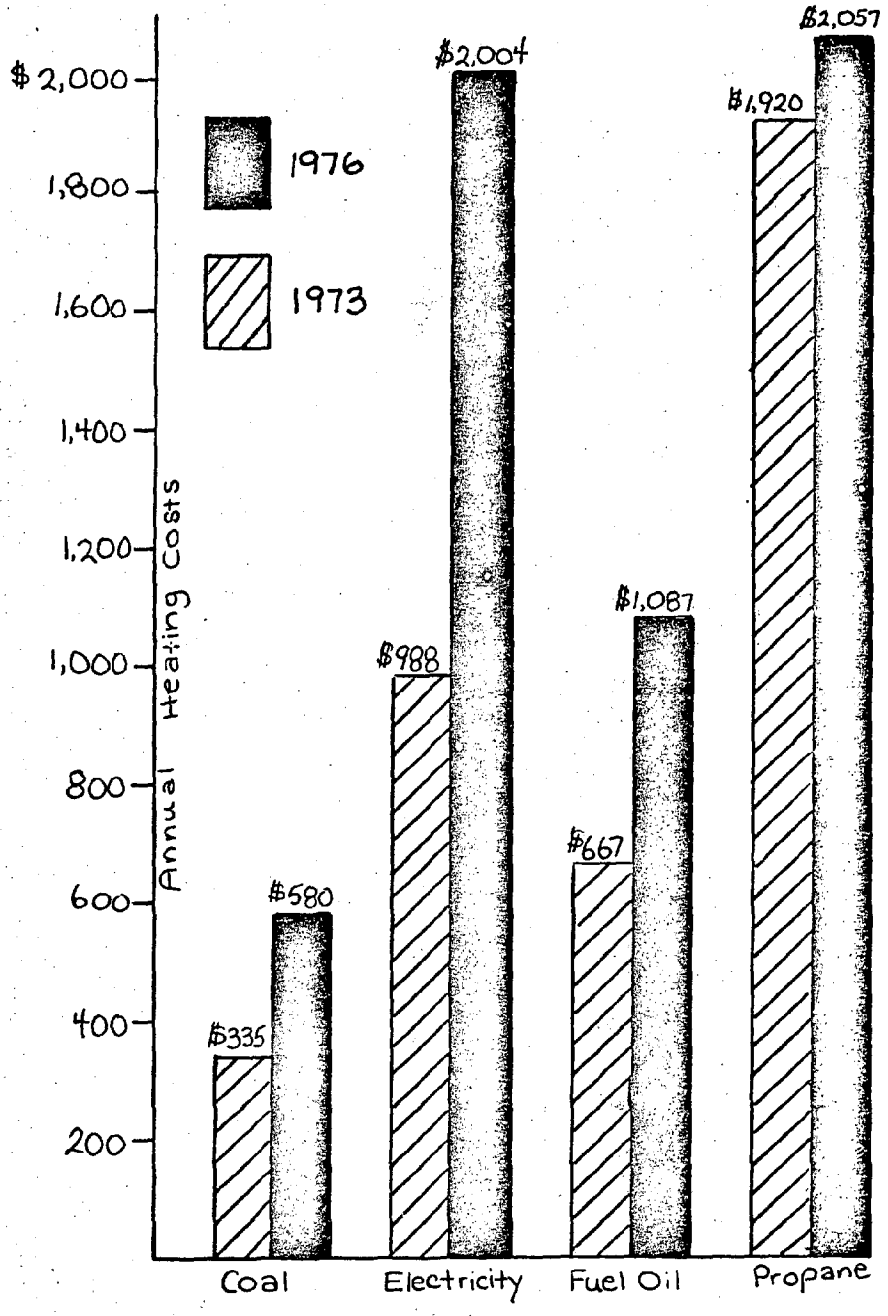
Fuel	Unit	Annual Costs: Cost/ Unit	X No. of Units	= Fuel Cost	+ Delivery or Other Charges	+ Tax Rate	= Total Heating Costs	Average Monthly Heating Costs
Fairbanks - aver. annual temp. 25.6°F								
Bituminous Coal - City	ton	$30.50	13	$ 397	$12/ton	5%	$ 580	$ 48
Bituminous Coal - 10 miles outside city	ton	$30.50	13	397	$12/ton	2%	564	47
Electricity - MUS	kwh	4¢	52,392	2,096	-	5%	2,201	183
Electricity - GVEA	kwh	3.75¢	52,392	1,965	-	2%	2,004	167
Fuel Oil	gal.	56.9¢	1,910	1,087	-	-	1,087	91
Propane	gal.	73.9¢	2,783	2,057	-	-	2,057	171
Spruce Wood	cord	$45.00	22	990	-	2%	1,010	84
Anchorage - aver. annual temp. 35°F								
Electricity	kwh	1.6¢	40,917	$ 655	-	-	$ 655	$ 55
Fuel Oil	gal.	46.1¢	1,492	688	-	-	688	57
Natural Gas	ccf.	12¢	1,995	290	$8	-	298	25
Propane	gal.	62¢	2,173	1,347	-	-	1,347	112
Spruce Wood	cord	$45.00	17	765	-	-	765	64
Juneau - aver. annual temp. 42.8°F								
Electricity	kwh	3.6¢	31,970	$1,151	3%	3%	$1,186	$ 99
Fuel Oil	gal.	44.3¢	1,166	517	-	-	517	43
Spruce Wood	cord	$45.00	13	585	-	-	585	48
Seattle - aver. annual temp. 53.2°F								
Electricity	kwh	1.2¢	19,351	$ 232	$18	-	$ 250	$ 21
Fuel Oil	gal.	42.9¢	706	303	-	-	303	25
Natural Gas	therms	24.68¢	944	233	-	7½%	250	21

*For detailed information on rates and other costs for different types of fuels see other tables in this section.

Source: Determination of fuel and heating requirements for a typical house in each city were made for the Impact Center by Axel R. Carlson, Extension Engineer, Cooperative Extension Service, U of A, Fairbanks. Fuel costs/unit were determined by an Impact Center survey of suppliers.

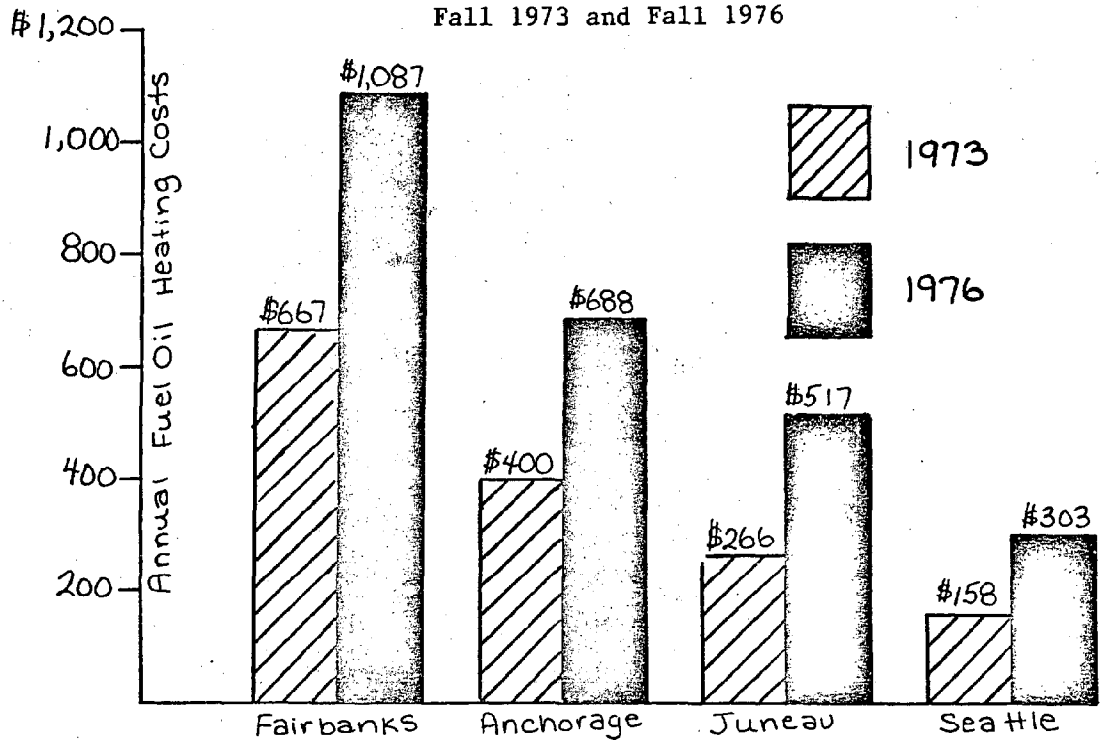
Wood heating costs were included in the comparisons primarily so readers could determine the quantity of wood required to heat a home. Most people who use wood as their primary heat source in Fairbanks cut and split their own. Increases in the cost of other energy sources has encouraged many Fairbanks residents to install auxiliary wood stoves to supplement other heating fuels and lower heating costs.

Figure 13
ESTIMATED ANNUAL HEATING COSTS FOR A TYPICAL HOUSE
Coal, Electricity, Fuel Oil and Propane
Fairbanks, Alaska
Fall 1973 and Fall 1976



Source: Determination of fuel and heating requirements for a typical house (see Table 16) were made for the Impact Center by Axel R. Carlson, UA Cooperative Extension Service. Fuel costs were determined by an Impact Center survey of suppliers.

ESTIMATED ANNUAL FUEL OIL HEATING COSTS
FOR A TYPICAL HOUSE*
Fairbanks, Anchorage, Juneau, and Seattle
Fall 1973 and Fall 1976



*See "typical house" specifications on page 34.

Source: Determination of fuel and heating requirements for a typical house in each city were made for the Impact Center by Axel R. Carlson, Extension Engineer, Cooperative Extension Service, U of A, Fairbanks. Fuel costs/unit were determined by an Impact Center survey of suppliers.

The statistics from the previous chapter showed that the price of heating oil in Fairbanks in 1976 was 23 percent higher than Anchorage. However, this comparison does not account for the climatic differences in the two communities. The mean annual temperature in Fairbanks is 25.6°F, compared to 35°F in Anchorage. Thus a comparison of heating oil prices alone is insufficient to determine the actual cost differences. Carlson's computer run of a "typical house" found that it would cost 1,087 annually for heating in Fairbanks compared to $688 in Anchorage, or 58 percent more. Comparisons of heating costs for a variety of fuels for Fairbanks, Anchorage, Juneau and Seattle are shown in Table 16. Figure 14 compares the estimated annual fuel oil heating costs for these cities for 1973 and 1976.

Household Electrical Consumption

As discussed in the next chapter, MUS statistics indicate that average electrical consumption of Fairbanks households increased from 5,914 kwh annually in 1971 to 6,791 in 1976, an increase of 15 percent. Higher household electrical consumption is also a national trend and relates primarily to a proliferation of electrical appliances. Additionally, modern appliances often use more electricity than older models. The most popular hair dryers, for example, are those with high wattage. Most refrigerators and freezers on the market are now frost-free models which use more electricity than manual defrost models.

ESTIMATED ANNUAL ELECTRICAL CONSUMPTION
Household Appliances

	Estimated Annual kwh Used
Food Preparation	
Blender	15
Broiler	100
Carving Knife	8
Coffee Maker	106
Dishwasher	363
Frying Pan	186
Hot Plate	90
Mixer	13
Oven, Microwave (only)	190
Range	
With oven	1,175
With self-clean-oven	1,205
Roaster	205
Toaster	39
Trash Compactor	50
Waffle Iron	22
Food Preservation	
Freezer (15 cu. ft.)	
Manual Defrost	1,195
Frostless	1,761
Refrigerator (12 cu. ft.)	
Manual Defrost	728
Frostless	1,217
Refrigerator/Freezer (14 cu. ft.)	
Manual Defrost	1,137
Frostless	1,829
Laundry	
Clothes Dryer	933
Iron (hand)	144
Washing Machine	
Automatic	103
Non-automatic	76
Water Heater	
Standard	4,219
Quick Recovery	4,811

	Estimated Annual kwh Used
Housewares	
Clock	17
Floor Polisher	15
Sewing Machine	11
Vacuum Cleaner	46
Comfort Conditioning	
Air Cleaner	216
Air Conditioner (room)	860*
Dehumidifier	377
Fan	
Attic	291
Circulating	43
Rollaway	138
Window	170
Heating Pad	10
Humidifier	163
Health & Beauty	
Hair Dryer	14
Heat Lamp (Infrared)	13
Shaver	1.8
Sun Lamp	16
Tooth Brush	0.5
Home Entertainment	
Radio	86
Radio/Record Player	109
Television	
Black & White Tube Type	350
Black & White Solid State	120
Color Tube Type	660
Color Solid State	440

*Based on 1000 hours of operation per year. This figure will vary widely depending on area and specific size of unit.

Source: City of Fairbanks, Municipal Utilities System, May 1976 newsletter.

Table 17 gives estimates of annual electrical consumption for a variety of household appliances. Consumers who wish to compare these figures with their own consumption can make estimates by multiplying the wattage of the appliance by the estimated hours used in a year and then dividing by 1,000.

The Cost of Owning and Operating a Vehicle in Fairbanks

For most Fairbanks residents access to transportation requires owning a vehicle. A bus route between the downtown area and the University of Alaska has operated for several years, but it has only been within the last year that the Borough has established a mass transit system which is planned to eventually serve most of the metropolitan area. In general all costs relating to vehicle ownership in Fairbanks are higher than the "Lower 48." The unusually long cold Fairbanks winters reduce the efficiency of the combustine engine. The result is lowered gas mileage, higher pollution, and higher operating costs.

A variety of personal preferences and other factors can also affect gas mileage and other vehicle ownership costs. Some persons prefer to do all routine maintenance themselves. Others have such work done by an auto dealer or service station. Some vehicles are kept in heated garages. Some persons leave vehicles idling for long periods before driving, while others start the engine and drive off immediately.

Although aware of the potential for individual variations, the Impact Center attempted to arrive at cost estimates for buying and operating a new vehicle for three years. For comparative purposes three vehicles were chosen - an imported sub-compact sedan, a full-size American sedan, and a four-wheel drive three-quarter-ton pickup. In pricing these vehicles the Impact Center allowed for options such as a radio, power steering in the American sedan and pickup and other features which dealers indicated were commonly purchased. Also included in the purchase price were options which are considered necessary or advisable for winter driving conditions such as a headbolt heater, battery warmer, two extra studded snow tires, positration and a rear window defogger.

As noted previously, determining gas mileage is subject to individual variation. To arrive at an average Impact Center staff informally surveyed Borough employees and others to arrive at averages for the three types of vehicles: 25 miles per gallon (mpg) for the imported sub-compact, 14 mpg for the full-size American sedan and 10 mpg for the pickup.

The results of this estimating procedure are summarized in Table 18. When the cost of depreciation, financing, insurance, fuel and maintenance were tallied, they revealed that over a three-year period an owner could expect to pay $1,949 annually to operate the sub-compact, $2,929 for the full-size sedan and $3,562 for the pickup. That computes to an average cost per mile of 16¢ for the sub-compact, 24¢ for the sedan and 30¢ per mile for the pickup.

ESTIMATED VEHICLE OWNERSHIP COSTS
Fairbanks, Alaska
1977

	Sub-compact Imported Sedan	Full-size American Sedan	4-Wheel drive 3/4-ton Pick-up
Three-Year Capital Costs			
*Initial purchase price	$4,150	$6,600	$7,900
Interest (based on an interest rate of 11.8% and financing 75% of purchase for 3 years)	600	940	1,125
Trade-in after three years (based on depreciation of 30% for first year and 7% for each year after first)	-2,500	-3,950	-4,700
Total 3-Year Capital Costs	$2,250	$3,590	$4,325
Annual Costs			
- Capital (1/3 of above total)	750	1,197	1,442
- Fuel -- at 80¢ gallon -- for 12,000 miles (based on 25 mpg for sub-compact, 14mpg for full-size sedan, and 10mpg for pick-up)	384	686	960
- Insurance	415	545	560
- Maintenance, Repairs, Misc.	400	500	600
Total Annual Costs	$1,949	$2,928	$3,562
Average Cost Per Month	163	244	297
Average Cost Per Day	5.34	8.02	9.76
Average Cost Per Mile	16¢	24¢	30¢
Total Three Year Costs	$5,847	$8,784	$10,686

*The initial purchase price was based on the cost of a 1977 model equipped with options which are usually added, such as a radio; and options which are considered necessary for winter driving, such as snowtires, winterization package, and positraction.

Source: Impact Information Center Survey of Fairbanks auto dealers, service stations and insurance companies.

Chapter V

ELECTRIC UTILITIES IN FAIRBANKS

Overview

The Fairbanks area is served by two electric utilities: The Electrical Department of the Fairbanks Municipal Utilities System (MUS) which serves most of the city, and Golden Valley Electric Association (GVEA) which provides power to the outlying areas. MUS is controlled by a Public Utilities Board (PUB), but rate increases, the budget, and major contracts must also be approved by the Fairbanks City Council. GVEA is a consumer-owned cooperative run by a seven-member board of directors who are elected from the districts in which they reside.

MUS serves the area within the City boundaries approximately as they existed in 1963. The utility's generating facilities, located on the Chena River near downtown Fairbanks, utilize a combination of coal-fired steam turbines, gas turbines and diesel engines.

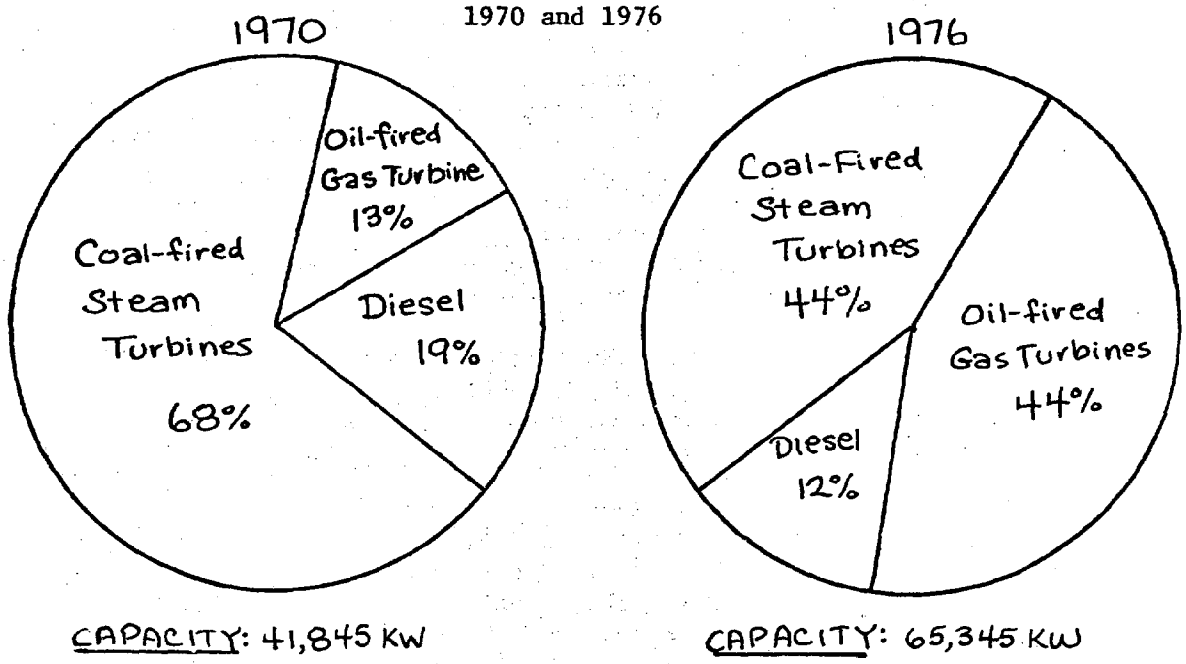
Table 19
GENERATING CAPACITY
MUS Electrical Department
Fairbanks, Alaska
March 1977

No.	Type of Generator	Date of Installation	Output Voltage	Capacity
Chena 2	Steam Turbine	1952	4.16 kv	2,000 kw
Chena 3	Steam Turbine	1952	4.16 kv	1,500 kw
Chena 1	Steam Turbine	1954	4.16 kv	5,000 kw
Chena 4	Gas Turbine	1963	12.47 kv	5,350 kw
Diesel 1	Diesel Engine	1967	12.47 kv	2,665 kw
Diesel 2	Diesel Engine	1968	12.47 kv	2,665 kw
Diesel 3	Diesel Engine	1968	12.47 kv	2,665 kw
Chena 5	Steam Turbine	1970	12.47 kv	20,000 kw
Chena 6	Gas Turbine	1976	12.47 kv	23,500 kw

Source: Fairbanks Municipal Utilities System

In 1976 the total capacity of the MUS system was 65,345 kilowatts (kw), a 56 percent increase from the 1970 capacity of 41,845 kw. In increasing its capacity, MUS has greatly decreased its dependence on coal and increased dependence on oil-fired gas turbines. As Figure 15 illustrates, in 1970 68 percent of the MUS system capacity was derived from coal-fired steam turbines, compared to 44 percent in 1976. In 1970 only 13 percent of the utility's capacity was oil-fired gas turbines,

Figure 15
FUELS FOR POWER GENERATION
MUS Electrical Department
Fairbanks, Alaska
1970 and 1976



Source: Fairbanks Municipal Utilities System.

GVEA serves areas which have been annexed to the city since 1963 such as Hamilton Acres, Lemeta, Johnston, and Aurora subdivisions, the borough areas outside the city, and highway communities from Healy to Delta. GVEA has generating plants in Fairbanks, Healy, Delta and North Pole with a total generating capacity of 166,000 kw, a 172 percent increase over its 1970 capacity of 61,000 kw.

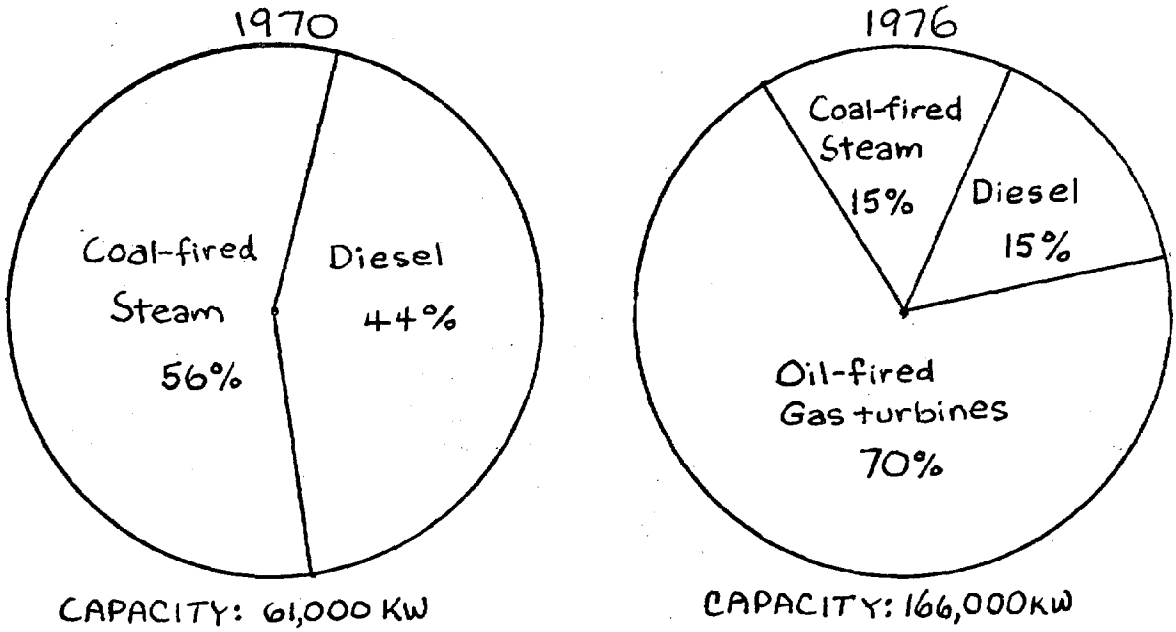
In 1967 GVEA completed a 25,000 kw coal-fired generating plant adjacent to the mine at Healy. This plant supplied the bulk of the cooperative's power needs until November 1976 when a new 70,000 kw oil-fired gas turbine was installed at North Pole near the North Pole refinery which is presently under construction. GVEA has also decreased the proportion of its coal generation capacity and increased dependence upon oil-fired gas turbines for peaking power. As Figure 16 shows, in 1970 56 percent of GVEA's capacity was coal-fired, compared to only 15 percent in 1976. In 1970 none of GVEA's capacity was from gas turbines, but now gas turbines account for 70 percent of its capacity.

The increase in GVEA's residential customers reflects the large amount of new construction which occurred in the outlying areas to meet the housing needs of the community's expanding population during pipe-

Table 20
GENERATING CAPACITY
Golden Valley Electric Association
Fairbanks, Alaska
March 1977

No.	Type of Generator	Capacity Per Unit	Year Installed	Location	Total Capacity
8	Diesel	3,000 kw	1961, 1964 and 1970	Fairbanks	24,000 kw
1	Coal-fired	25,000 kw	1967	Healy	25,000 kw
2	Gas turbines	20,000 kw	1971, 1972	Fairbanks	40,000 kw
2	Gas turbines	3,500 kw	1975	Fairbanks	7,000 kw
2	Diesel	250 kw	1975	Delta	500 kw
1	Gas turbine	70,000 kw	1976	North Pole	70,000 kw
				Total:	166,000 kw

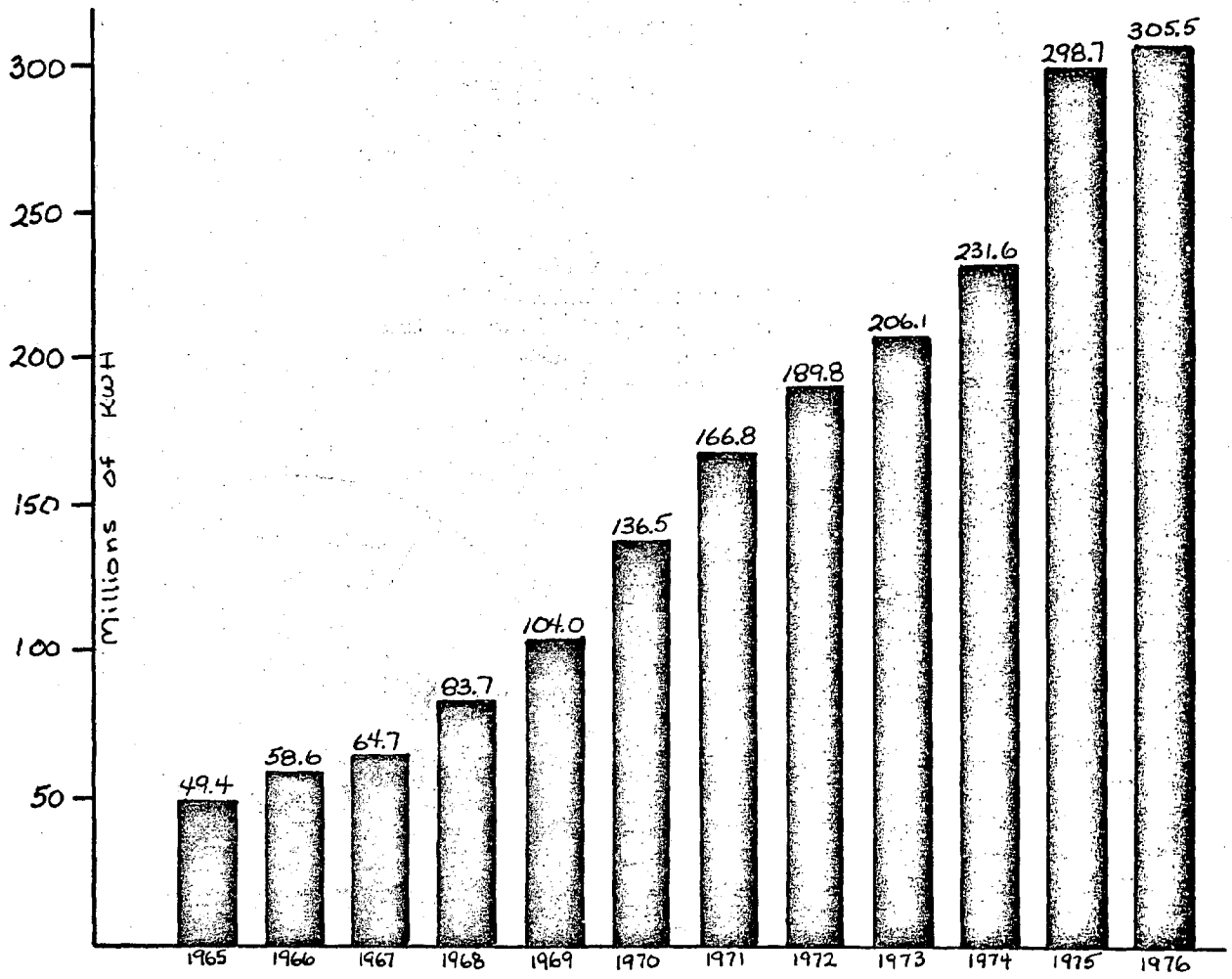
Figure 16
FUELS FOR POWER GENERATION
Golden Valley Electric Association
Fairbanks, Alaska
1970 and 1976



Source: Golden Valley Electric Association.

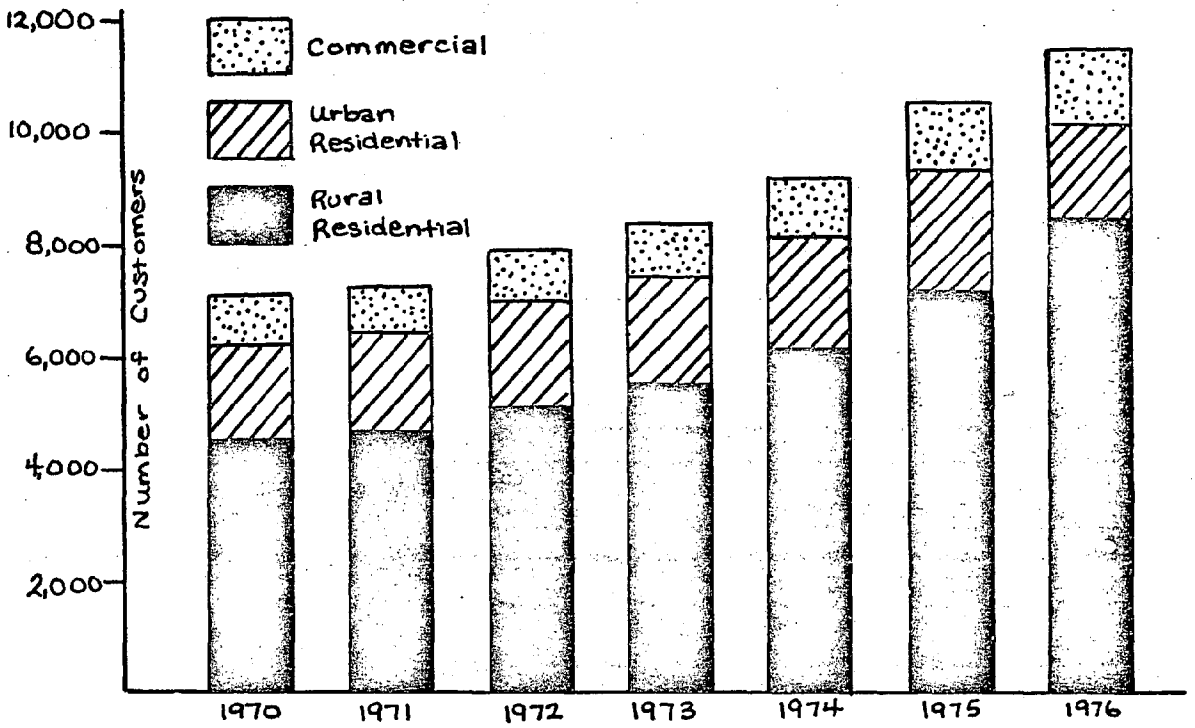
line construction. The increase in the number of GVEA's large commercial customers is more directly related to the pipeline since these include power to Pump Stations 8 and 9, the pipeyard, and the North Star Terminals Complex. In addition, GVEA has served a number of new pipeline-related businesses in areas such as the airport, Van Horn Road and Peger Road areas.

Figure 17
KILOWATT HOURS (KWH) OF ELECTRICITY SOLD
Golden Valley Electric Association
Fairbanks, Alaska
1965 - 1976



Source: Golden Valley Electric Association.

Figure 18
RESIDENTIAL AND COMMERCIAL CUSTOMERS
Golden Valley Electric Association
Fairbanks, Alaska
1970 - 1976



	Residential			Commercial			
Year	Rural	Urban	Total Residential	Under 50 kw	Over 50 kw	Total Commercial	Total Customers
1970	4,494	1,730	6,224	786	58	844	7,068
1971	4,644	1,789	6,433	816	60	876	7,309
1972	5,073	1,874	6,947	856	60	916	7,863
1973	5,469	1,913	7,382	901	72	973	8,355
1974	6,093	1,989	8,082	987	85	1,072	9,154
1975	7,146	2,097	9,243	1,083	126	1,209	10,452
1976	8,416	2,264	10,680	1,064*	301*	1,365	12,045

*Change in commercial rate classification.

Source: Golden Valley Electric Association.

Figure 17 illustrates the growth GVEA has experienced since 1965. Between 1970 and 1973 the number of kilowatt hours sold by GVEA increased from 136.5 million to 206.1 million, a 51 percent overall increase and an average annual increase of 14.6 percent. From 1974 to 1975, at the peak of the pipeline boom, GVEA increased its electricity production by 29 percent. In 1976 GVEA sold only 2 percent more electricity than the previous year. This leveling in demand is attributed to an unusually mild winter and the slow down in population and economic growth associated with completion of the pipeline.

Trends in Demand for Electrical Services

Between 1970 and 1976 the number of customers served by GVEA increased from 7,068 to 12,045, a 70 percent increase. Most of GVEA's growth may be attributed to an increase in rural residential customers. Between 1970 and 1976 the number of rural residential customers increased 87 percent from 4,494 to 8,416. Figure 18 summarizes trends in the number of residential and commercial GVEA customers.

The growth experienced by the MUS Electrical Department has been small in comparison to GVEA. The number of customers served by MUS increased from 5,510 in 1971 to 5,831 in 1976, a 6 percent total increase for the period and an average annual increase of about 1 percent. The main reason for the slower growth is that the area served by MUS is limited. Table 21 summarizes the number and types of MUS customers for 1971 through 1976.

Table 21
ELECTRICAL CUSTOMERS
Fairbanks Municipal Utilities System
1970 - 1976

Year	Residential	Commercial	Other	Total
1971	4,493	846	171	5,510
1972	4,540	884	181	5,605
1973	4,443	910	177	5,530
1974	4,618	941	171	5,730
1975	4,634	968	167	5,769
1976	4,687	978	166	5,831

Source: Fairbanks Municipal Utilities System

Between 1971 and 1976 the number of residential customers increased only 4 percent, while the number of commercial customers increased 16 percent. This difference reflects changes in land use within the city during the pipeline period which caused an increase in "vertical growth" - such as multi-story office buildings, apartments, hotels and motels.

Although the number of residential customers has remained relatively constant, the amount of electrical consumption per residential customer increased from 5,914 kwh in 1971 to 6,791 in 1976. It is possible that this increased consumption was the result of higher incomes. A community survey conducted in 1976 by Jack Kruse ("Research Notes: Fairbanks Community Survey," Institute of Social and Economic Research, UA Fairbanks, December 1976) found that within the previous year 23 percent of those surveyed had purchased major appliances such as washers, driers, stereos, television sets and freezers, all of which typically use large amounts of electricity. Another partial explanation is that one of the most frequent ways people coped with the housing shortage in recent years was to "double-up." Thus a large number of persons living in a house or apartment would likely consume more electricity.

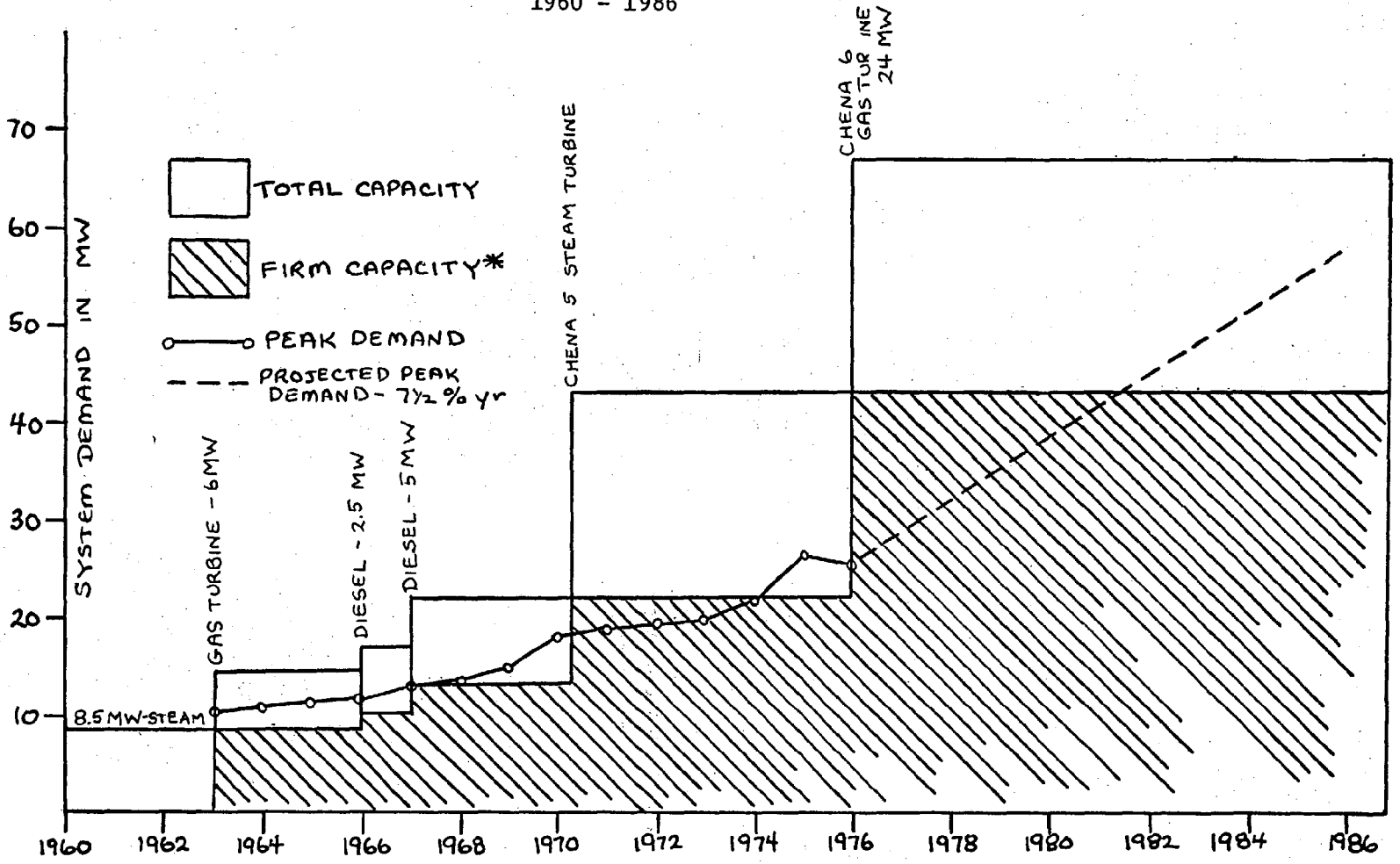
Power Outages and Peak Loads

A major population increase, combined with extremely cold weather, put unprecedented demands on both MUS and GVEA during the winters of 1974-75 and 1975-76. There was much concern that increased demand would overload the existing systems. There are basically two types of power outages. The first is a localized power outage which can occur due to faulty home wiring, a fire, or damage to a wire or telephone pole. Such outages are typically minor and affect only a few customers. The second, and potentially more serious types of power outages, are those which occur because an inadequate amount of electricity is generated to meet the demand. This usually occurs when one or more of the generating units fails. Since generating units frequently must be shut down for maintenance, a utility is required to have a reserve generating capacity. Thus, an electric utility must have "firm capacity" sufficient to meet the electrical demands of its customers if the largest generating unit in the system is inoperative. Figures 19 and 20 illustrate total and firm capacities for the MUS and GVEA system plotted against peak demand. During 1975 peak electrical demands for both systems exceeded firm capacity.

The most serious power outages are likely to occur when several generators fail during periods of extreme cold temperatures when demand for electricity is high. This type of power outage threatened the GVEA system several times during the winter of 1975-1976. As a result GVEA instituted a consumer education program aimed at reducing electric consumption during critical times. The "peak load alerts," which were issued via the news media, requested customers to cut back on electrical consumption by turning off unnecessary lights, turning off hot water heaters, lowering thermostats and discontinuing use of major appliances such as ovens, washers, dryers and dishwashers.

GVEA warned that if the peak load alerts were insufficient to reduce consumption, the utility would have to cycle power on and off

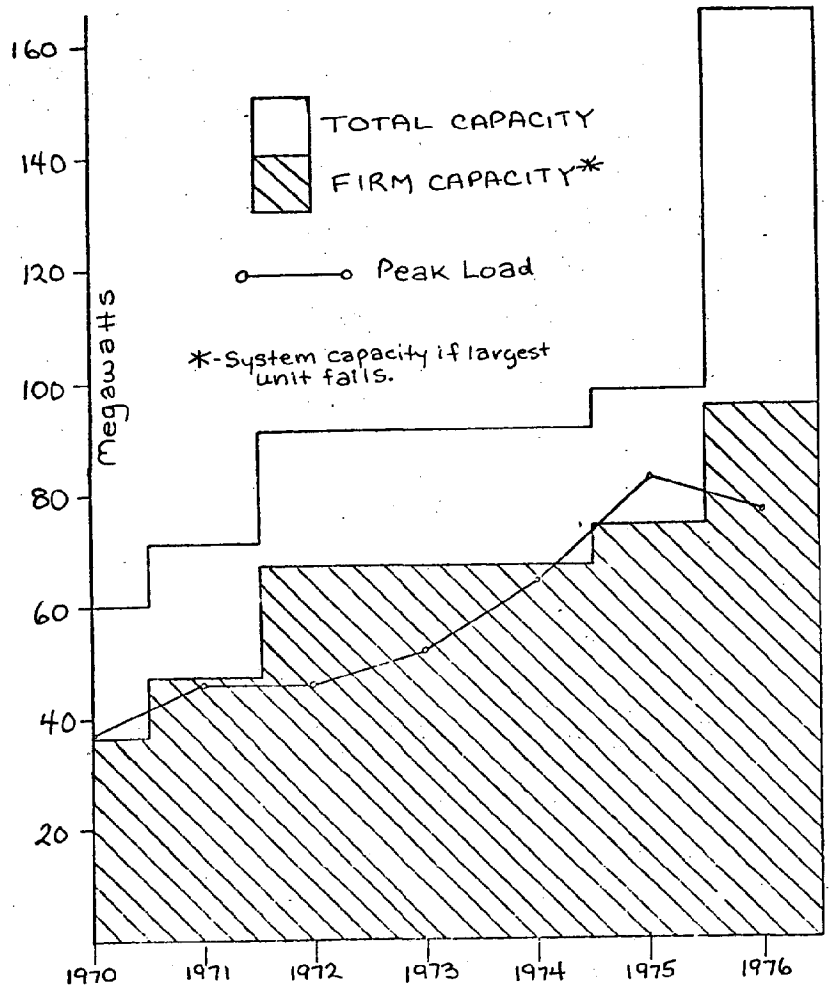
GENERATING CAPACITY AND PEAK ELECTRICAL DEMAND
Fairbanks Municipal Utilities System
1960 - 1986



* System capacity if largest unit fails.

Source: Fairbanks Municipal Utilities System.

Figure 20
GENERATING CAPACITY AND PEAK ELECTRICAL DEMAND
Golden Valley Electric Association
1970 - 1976



Source: Golden Valley Electric Association.

by area on a rotating basis. However, the alerts proved helpful in lowering consumption and cycling power was not required.

As further insurance against power outages, GVEA urged its customers to install home generators. GVEA's November 1975 newsletter said:

> *Purchasing a portable electric generator is simply buying an insurance policy. Considering our climate, it only makes good sense. No utility in the world guarantees 100 percent reliability and no utility in the world provides it.*

However, the purchase of generators is beyond the financial means of many GVEA customers. A newspaper article at the time pointed out that

the cost of such units ran from $467 for a gas model to $2,000 for a diesel one. In lieu of a generator GVEA suggested an alternate heat source.

One common method used to avert a power outage is to purchase excess power from another utility. GVEA and MUS have a power pooling agreement with each other and are interconnected with all major power plants in the Interior except Clear Air Force Base. Thus the utilities can have access to emergency power from Eielson Air Force Base, Fort Wainwright, Ft. Greely, NASA at Gilmore Tracking Station, Murphy Dome and the University of Alaska.

Although most observers believed a complete power failure in Fairbanks was remote, an MUS official outlined the following scenario of priorities in case of a critical power failure:

> *If for some reason, such as the failure of several turbines, the MUS plant were unable to meet its entire power demand, and no power was available from GVEA, then a "brownout" probably would be ordered. . .*
>
> *This would mean reducing power to all customers, resulting in such effects as dimmer lights.*
>
> *The next step, if necessary . . . would be to cut off power for such non-essential uses as street lights and certain public buildings, such as those at Alaskaland.*
>
> *Next to go would be the more essential public buildings, followed by commercial buildings and schools.*
>
> *The last available power . . . would be reserved for such vital facilities as the hospital (which has its own backup power generating capacity) and private homes. (Fairbanks Daily News Miner, October 23, 1975.)*

As noted previously, both the MUS and GVEA systems have greatly increased their reliance on fuel oil to generate electricity in recent years. Therefore, another reason for a serious power outage could be a fuel oil shortage. In November, 1975, GVEA's supplier, Tesoro Petroleum COmpany, informed the utility that it could not supply enough diesel to meet GVEA's needs. GVEA officials calculated that their fuel supply would be exhausted in a few days. The utility warned that if the shortage were not averted, half the association's generating capacity would be idled, forcing blackouts on a rotating area-by-area basis. The crisis was averted by an emergency pooling of power from Eielson Air Force Base, Fort Wainwright and MUS.

Tesoro said they could not supply the increased GVEA demand without jeopardizing their other customers who depended on the company for heating oil. Tesoro explained that GVEA's diesel consumption had

increased from 600,000 gallons in November 1974 to 1.3 million gallons in the first 14 days of November 1975. GVEA said their increased consumption was caused by record-breaking low temperatures, a decision by the secretary of the Army not to sell GVEA reserve coal-fired power from the military bases, and a greater than anticipated number of new customers on the system. When the Federal Energy Administration (FEA) and GVEA attempted to get fuel from another supplier, they found that tank cars were tied up on a priority basis by Alyeska Pipeline Service Company for pipeline construction and the Department of the Army for transport of fuel to Petroleum Reserve No. 4. Alyeska Pipeline Service Company and Eielson Air Force Base agreed to divert their fuel reserves and these emergency allotments were sufficient to get GVEA through the crisis. The FEA then arranged for Union Oil Company to be GVEA's "interim alternate supplier."

Although the fuel crisis was averted, less than two weeks later a combination of extremely cold weather and generator troubles caused GVEA to issue peak load alerts asking area residents to curtail power usage. Alerts were broadcast over local radio stations at 14 minute intervals. GVEA had issued similar warnings in previous years after power outages, but this was the first time such warnings had been given in advance. GVEA officials estimated that power usage dropped about 5,000 kilowatts as a result of the broadcast; but GVEA also estimated that it could have been cut by 7,000 to 10,000 kilowatts if everyone had participated. A peak load usage of about 82,000 kilowatts was expected. Because of the warnings, usage peaked at about 77,000 kilowatts.

In contrast to the two previous pipeline winters, 1976-77 was not marked by potential power problems. This was the result of an unusually warm winter, a leveling in economic growth, and an increase in the generating capacities of both the MUS and GVEA systems. GVEA installed a new 70,000 kw gas-turbine-fired power plant at North Pole in November 1976. The new facility also has a storage capacity of 1.8 million gallons of oil, compared to a 235,000 capacity the previous year when a fuel shortage threatened to cut electric power.

In the winter of 1975-76 MUS's main generator, Chena 5, broke down several times and needed repair and maintenance. It received a major overhaul in summer 1976 at a cost of a half million dollars. In addition, in December 1976 a new 29-megawatt gas turbine generator, Chena 6, became operational. This new generator is not expected to be needed this winter, but it increases the firm capacity of MUS and serves as an insurance policy against power shortages until the city's population and power demand increase substantially.

MUS Rate Increases

As a municipally owned utility, MUS rate increases are proposed

by the management and the Public Utility Board (PUB), but must be approved by the City Council. MUS rates are not subject to regulation by the Alaska Public Utilities Commission (APUC). For several years the City Council has vigorously resisted MUS rate increases, In October 1975 the PUB requested an 8.21 percent increase in MUS electrical rates. The Council turned down the request and substituted a 4 percent rate increase in February 1976. A *Fairbanks Daily News Miner* editorial suggested that the management of the city's utilities should be less subject to the political pressures of the city council:

> *The city council and the customers of MUS should take a close look at the idea of pushing MUS and the Public Utilities Board farther away from the political influences of the council, and giving the PUB proper authority to do its job. . .*
>
> *. . .it was the council that stalled for a year studying the rate increases proposed by the MUS management and the PUB in 1972. That procrastination of our councilmen while they second-guessed long deliberation and decisions already made by MUS board members significantly delayed MUS' preparation for the pipeline boom. Council members are still arguing over issues proposed in that round of debate four years ago. . .*
>
> *MUS has grown into a big business as the rest of Fairbanks has grown and diversified. It should no longer be a stepchild of the city government, but a large business in its own right with the city government as one of its largest customers. (Fairbanks Daily News Miner, May 25, 1976)*

In June 1976 the MUS Controller resigned, citing frustrations from dealing with the City Council as one of his major reasons. He said the council had frequently ignored recommendations from the PUB. He was especially critical of the four months the countil took to approve an electric rate increase which was authorized at less than half of the original request. He predicted:

> *If we continue on the way we are, the electric department is going to lose $1-2 million, not to mention the money needed for power plant maintenance. (Fairbanks Daily News Miner, June 22, 1976)*

In July 1976 the MUS management requested a 19 percent increase in electrical rates. They said the increase included 6 percent to cover the cost of a new gas turbine generator, 9 percent for increased fuel and labor costs, plus the 4 percent the council had refused to approve the previous fall. The PUB provided financial data which indicated that the electric department had been losing money for several months and it was anticipated that the total loss by the end of 1976 would be nearly a million dollars if the increase were not granted. The City Council approved the 19 percent rate increase in September 1976.

Inadequate utilities have been identified as one of Fairbank's most serious problems during the pipeline boom. It appears likely that better planning could have averted much of this impact. A former MUS manager noted that early in 1973 MUS consultants had identified the need for a 24 percent increase in electrical rates, yet it was not until February 1976 that the City Council approved a rate increase, and it was only 4 percent. The additional 19 percent increase followed seven months later, after the peak of pipeline activity.

GVEA Surcharge and Rate Increases

In contrast to the MUS system, GVEA is regulated by the Alaska Public Utilities Commission (APUC). In 1974 GVEA applied to the APUC for a rate increase to cover mounting fuel costs. In 1972 GVEA paid 19.75 cents per gallon for fuel oil used to produce electricity and by 1974 the price had nearly doubled. The APUC told the utility to implement a fuel "surcharge" until a final determination on the rate increase could be made. The APUC chose 1972 as the "base year" used to calculate on a three month average what it cost the utility to produce a kilowatt hour of electricity. The surcharge represented the difference in cost between producing kilowatt hours of electricity with fuel at the base year price and producing electricity with fuel at the current price. The addition of the surcharge meant that electricity bills of GVEA customers, particularly those with electric heat, hit unprecedently high levels. Many GVEA customers were enraged:

> *I imagine everyone in Fairbanks has received their Golden Valley electric bill this month. If yours was anything like ours, something must be done about this rip-off!*
>
> *We have a small, two-bedroom house, total electric. Last month our total electric bill, including the surcharge, was $99. This month, our bill is $292.03. The surcharge is $110.45! This brings our electricity bill to almost double our house payment! (Letter to the editor, Fairbanks Daily News Miner, January 28, 1976.)*

One woman protested the surcharge by declaring a hunger strike and picketing the GVEA offices. Other consumers protested the continuation of GVEA's rate structure which gave preferential rates to customers who used more electricity. Another letter to the editor noted:

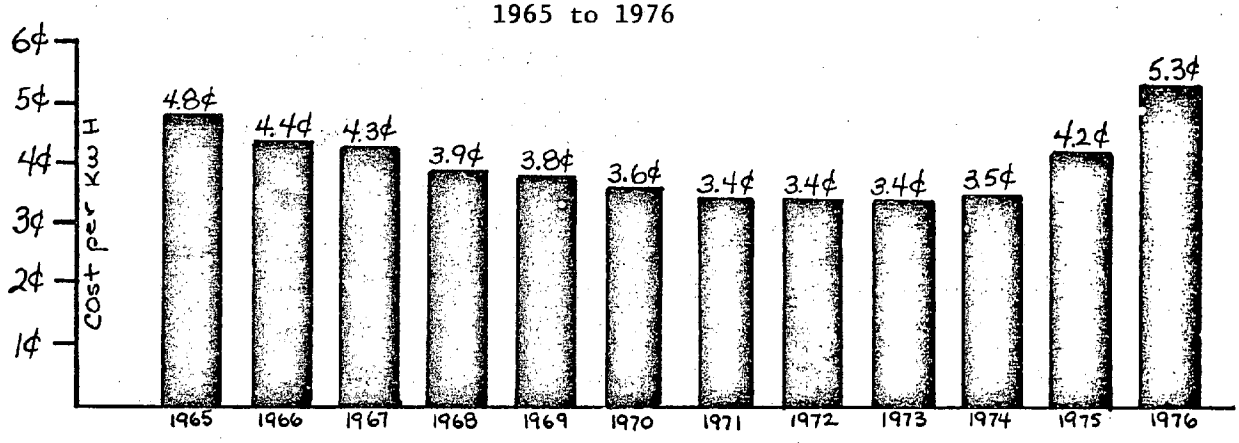
> *In examining the proposed rate increase as outlined in your Golden Valley Highlines paper, I note that again the benefit of lower rates go to the high consumer.*
>
> *To me this approach is completely unrealistic. Why should a person using only 100 kw have to pay $.10 per hour and the over 1200 kw users get their electricity for the $.0375 rate? In*

other words the more you use the cheaper it gets.

In these days of power shortages it would seem prudent to encourage conservation. What better method than the more you use the more you pay? (Fairbanks Daily News Miner, May 3, 1976).

Initially GVEA requested a 25 percent rate hike, but delays increased expenses and the amount of the request increased. By mid-1976 GVEA proposed rates to eliminate the surcharge and to increase residential rates by 48.7 percent over the existing base (non-surcharge) rate established in 1971. The new rate structure increased the cost of electricity to small commercial users 30.5 percent and 57.2 percent to large commercial users. The full rate increase request was approved by the APUC in October 1976. Figure 21 summarizes the average electrical cost per kilowatt hour for GVEA members from 1965 to 1976.

Figure 21
AVERAGE ELECTRICAL COST
TO MEMBER PER KILOWATT HOUR
Golden Valley Electric Association
1965 to 1976



Source: Golden Valley Electric Association

The Future of Electric Utilities in Fairbanks

In addition to the rapid expansion GVEA has achieved in the past year, it plans to install a second 70,000 kw generating plant in North Pole by December 1977. That will increase the utility's total generating capacity to 232,500 kw. This level is 181 percent higher than the highest peak load level (82,600 kw) ever experienced by GVEA and 97 percent above existing "firm capacity." The addition of this generator will increase the proportion of GVEA capacity fueled by gas turbines to 80 percent.

In March 1976 former Fairbanks newsperson Ben Harding termed GVEA's decision to build an oil-fired power plant instead of relying on coal a "serious miscalculation." Harding pointed out that estimates by an MUS consultant predicted that an increasing reliance on fuel oil would double the cost of power to GVEA users in the next few years.

Harding attributed the miscalculation to estimates on the future price of oil from the North Pole Refinery which were made in 1973 before the Arab oil embargo caused oil prices to soar. In 1973 it appeared that installation of the North Pole generators would provide additional generating capacity faster and cheaper than an addition to the utility's Healy coal-fired plant. Harding said that by the time GVEA recognized its mistake the financing arrangements had already been made with the Rural Electrification Administration (REA) and the demand for power in Fairbanks forced them to go forward. Harding described the reactions of other power producers to GVEA's actions:

> *Other power producers in this part of Alaska - the city of Fairbanks, the University of Alaska's Fairbanks campus, and Fort Wainwright - are watching with mounting disbelief as Golden Valley puts all its electric eggs in an oil-fired basket. Oil is too expensive, they believe, to be used for anything but the emergency generation of electric power. (All Alaska Weekly, March 5, 1976).*

GVEA officials acknowledged that coal is a cheaper fuel, but they explained that REA was pushing for oil-fired plants because they were less expensive to build. However, since that time, due to "project independence," it is easier to obtain REA funding for coal plants. GVEA spokesman Mike Kelly told Impact Center staff:

> *On the plus side, investment in the new oil-fired generators had to be made sooner or later. When the 150 kilowatt coal-fired generator is completed at Healy in 1983, emergency and peaking generators will be required in the Fairbanks area in case of generator or transmission line failure. The same would apply when power becomes available from the Devil's Canyon hydroelectric project.*

Although prices won't be as low as originally projected, GVEA is hopeful that fuel purchased from the North Pole Refinery, scheduled to begin production next fall, will reduce its fuel costs. Refinery President Frank DeLong recently predicted that the price of oil products from the refinery will cost about the same as those purchased in Anchorage. At the present time most fuels are 7 to 10 cents higher in Fairbanks than Anchorage. DeLong commented:

> *The only reason for us being here is for producing and selling fuels at a cheaper price, and we are committed to passing along some of the savings. (Fairbanks Daily News Miner, December 8, 1976).*

The eventual price of oil from the refinery is still in question and will be largely determined by the price the refinery will pay for oil shipped from Prudhoe Bay via the Alyeska pipeline. Neither the well-head price for the crude, nor the transportaiton tariffs have been set.

Earlier this year GVEA announced plans to build a 2.8 mile-long crude oil pipeline from the Alyeska pipeline to the refinery and GVEA generators in North Pole. GVEA officials say ownership of the pipeline would guarantee a continued flow of oil to its North Pole generators and the utility would also earn a tariff on oil shipped from the Alyeska pipeline to the refinery which could provide additional revenues of $600,000 annually. Before the project can be built GVEA must acquire financing and receive a certificate to build from the Alaska Pipeline COmmission.

Another project which has been considered is the construction of a new mine-mouth coal-fired generating plant at Healy. In mid-1976 GVEA and MUS announced that they were discussing the possibility of a joint venture to build a 150-megawatt Healy plant at an estimated cost of $150 million. Under the plan GVEA would receive 75 percent of the plant's capacity while the City of Fairbanks would receive 25 percent. GVEA has filed applications with the Alaska Department of Environmental Conservation and the U. S. Environmental Protection Agency for air quality and water discharge permits for the facility. The utilities feel the project is economically feasible due to the low price of coal; however, they anticipate major environmental hurdles since the plant would be located within a few miles of the border of Mt. McKinley National Park. New federal environmental quality legislation is expected to establish strict standards for air and water quality within a 100-mile radius of national parks.

Chapter VI

THE EFFECTS OF ENERGY CONSUMPTION ON AIR QUALITY

I got interested in pollution as soon as I got off the earth and looked back. The environment got visibly and progressively worse over the three space flights I took in 1962, 1965 and 1968. (Walter M. Schirra, Jr., June 16, 1970).

The astronaut quoted above was relating his personal, space-capsule view of a steadily expanding cloud of air pollutants off the South Texas shore. Since most Fairbanksans are constrained to await leaving this earth in a less dramatic fashion than a Saturn V, this report attempts to "look back" at the air pollution covering this spot on earth.

Fairbanks was established somewhat by accident in an area amenable to those economic mainstays of earlier times, trapping and gold mining. This was sparse criteria upon which to base the location of what would later become the commercial and transportation "hub" of a major, national mineral development program. At the time Fairbanks was settled, the significance of the extreme temperature inversions seasonally prevalent in the Fairbanks airshed was probably unknown.

A temperature inversion exists when air temperature increases with altitude. This unusual circumstance is important in air pollution considerations because its effect is to hold pollutants in the dense, cold air near ground level. This property of inversions, however, is further amplified in Fairbanks' situation because of the incredible "strength," or rate of temperature change, of the inversions found here, as compared to other locations. Benson describes the strongest inversion measured at the South Pole as 9.65°C/100 meters, whereas inversions of 10° to 30°C/100 meters are common during the Fairbanks winter. (Benson, C.S., "Ice Fog, Low Temperature Air Pollution," Cold Regions Research Engineering Laboratory, RR 121, June, 1970.)

Basically, there are two main causes of temperature inversions. One is the occurrence of warm air arriving from another locale on top of a cool air mass. This type of inversion is common in certain lower latitude cities and is the crude equivalent of placing a "bubble" over the city. A significant feature of this type inversion is that the air temperature is relatively constant and accommodates some mixing "inside the bubble" from the ground upward to the boundary between the two air masses. However, it is the second cause of temperature inversions, radiative loss of heat from the earth's surface, which is responsible for Fairbanks' wintertime inversions. This type of inversion begins essentially at ground level and accommodates very little dispersing of pollutants. The topography of the area further conspires to

aggravate the consequence of Fairbanks' temperature inversions. The hills on three sides of the city provide a natural basin protecting the strong, stable inversions from whatever winds might otherwise blow in alleviation.

Fairbanks has strong, ground-level, stable, and protected temperature inversions to serve as a vessel for air pollution problems. Only one other ingredient is essential to air pollution: the pollutants to fill this vessel.

As one might expect, and as the previous chapters detailed, people use an inordinate amount of heat energy to obviate the hardships of an Alaskan winter.

The principal technology for generating energy, whether it be for heat, electric power, or transportation, involves burning some type of fuel. The by-products of this combustion are emitted to the atmosphere in peak amounts during the periods when the airshed can least accommodate them.

The chemical and physical nature of these commonly occurring pollutants has been researched extensively, especially in recent years. However, most of the research originated in the context of "lower 48" urban situations. Adapting this knowledge to Fairbanks requires careful attention to the many environmental differences that sometimes invalidate for Fairbanks that which may be valid elsewhere. For example, the chemical behavior of many pollutants is known to depend upon reactions sensitive to sunlight. Interior Alaska, with its paucity of sunlight during winter and abundance of it in summer, may not fit the generally accepted predictions and modeling done in other areas.

Interior Alaska is essentially a desert with normally very dry ambient air, especially in winter. The only significant source of water vapor is provided by human activity. More specifically, water vapor is a common, and copious, end product of combustion. It will therefore co-exist with the other combustion products, some of which are harmful. Perhaps the most signal feature of Fairbanks' air pollution is the intriguing presence and behavior of ice fog. This phenomenon has its beginnings in the crystallization of water vapor in the very cold winter. The relationship between the tiny ice crystals and other pollutants is not thoroughly understood. It is known, however, that the fog crystals provide an absorbing surface and thereby concentrate air pollutants. (Benson, 1970, pp.67.) Also, serious air pollution episodes observed in other times and places usually occur in connection with fog conditions.

Since ice fog is a localized condition peculiar primarily to Fairbanks, it is not likely to excite a national concern as have other environmental matters. In fact, the United States Environmental Protection Agency (EPA) does not actually consider it a pollutant. Thus, it

is difficult to obtain the resources to adequately understand the full implications that ice fog may have for air quality. Nevertheless, some ice fog research is being conducted, and research results both provide greater understanding of the problem and stimulate questions for further research.

Carbon Monoxide

Another of Fairbanks' pollutants, which is fairly well understood, is also a combustion product -- carbon monoxide (CO). This pernicious substance is associated primarily, in Fairbanks and elsewhere, with automotive transportation. The liquid fuels burned in the internal combustion engine do not, for a variety of reasons, burn to completion. Carbon monoxide is one of the products of this incomplete, or more properly, oxygen deficient, combustion.

Carbon Monoxide and Health - Carbon monoxide is characterized by its tenacious ability to combine with blood hemoglobin to the exclusion of oxygen. In high concentrations, its short term effects on the human organism can be similar to hypoxia, or suffocation. Chronic, low-level exposure to CO causes health effects dependent upon a number of variables, including the current health of the recipient.

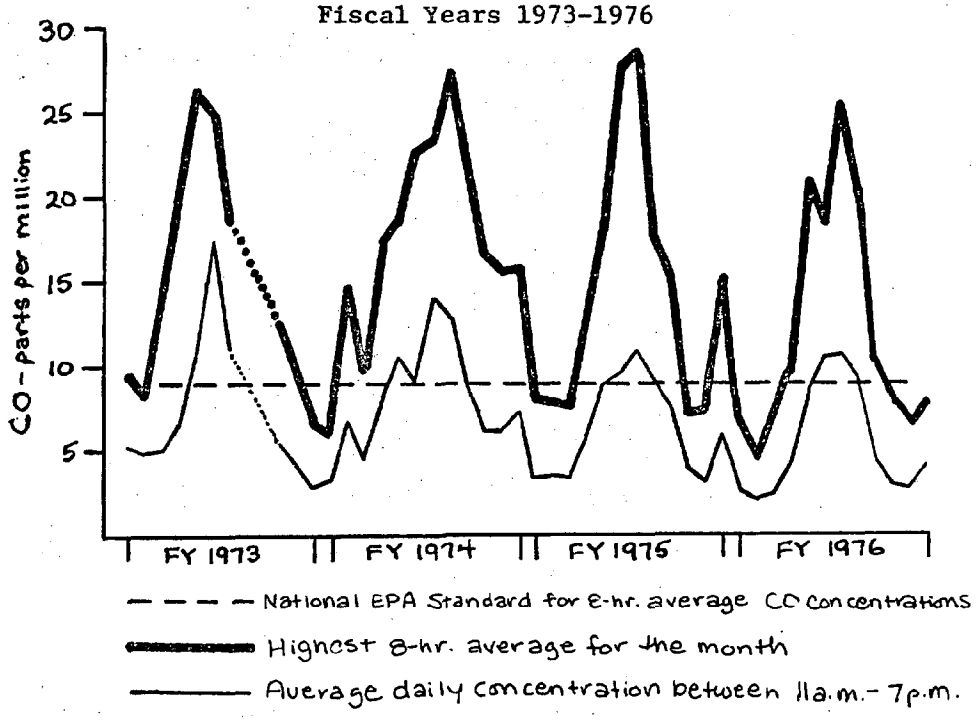
Legal Standards - In 1970, under mandate of Congress and after exhaustive study, the federal government established the concentration of nine parts carbon monoxide in one million parts air (9 ppm), averaged over eight consecutive hours, as the legal standard not to be exceeded more than once a year in a community. Less than this level, 9 ppm, is determined necessary to reasonably protect the health of all citizens from the harmful effects of CO. In 1974 this standard was reviewed by the National Academy of Sciences and the National Academy of Engineering for its adequacy or necessity. Their review contains the following:

1. *On the basis of the new data base, there is no reason to relax the existing carbon monoxide standard of 9 ppm for 8 hours. . .*

2. *. . .populations with coronary arterial disease and the other groups. . .are so numerous and so widely distributed in the population that protection from adverse effects of carbon monoxide in these groups requires general control of the air quality in the community.*

3. *. . .it is impossible to state whether this standard provides a margin of safety. ("Carbon Monoxide Exposure and Human Health," Richard W. Joy, et al.)*

Figure 22
CARBON MONOXIDE POLLUTION
Fairbanks Downtown Post Office
Fiscal Years 1973-1976



Source: Fairbanks North Star Borough, Environmental Services Department.

Table 22 and Figure 22 show that Fairbanks has frequently exceeded the legal standard. The data also indicates seasonal variation in the CO problem. Although Fairbanks still regularly exceeds the standard of 9 ppm for an eight-hour average, the violations are confined to a shorter season of the year and appear to be lessening in severity.

Particulates

This pollutant is defined as: "Any material, except uncombined water, in the form of solid or liquid in the atmosphere or gas stream." (Environmental Engineer's Handbook, Vol II, Chilton Book Company, 1974.)

This definition covers a very broad category of substances that range from the simply annoying to hazardous. As Table 22 and Figure 23 illustrate, Fairbanks occasionally violates the legal standard of 150 micrograms/cu. meter.

A primary source of particulates in Fairbanks is the loose, fine, and dry soils of the area which are easily displaced by human activity into the air as dust during summer. Other major sources of particulates are the forest fires that frequently occur in the Interior. Some of

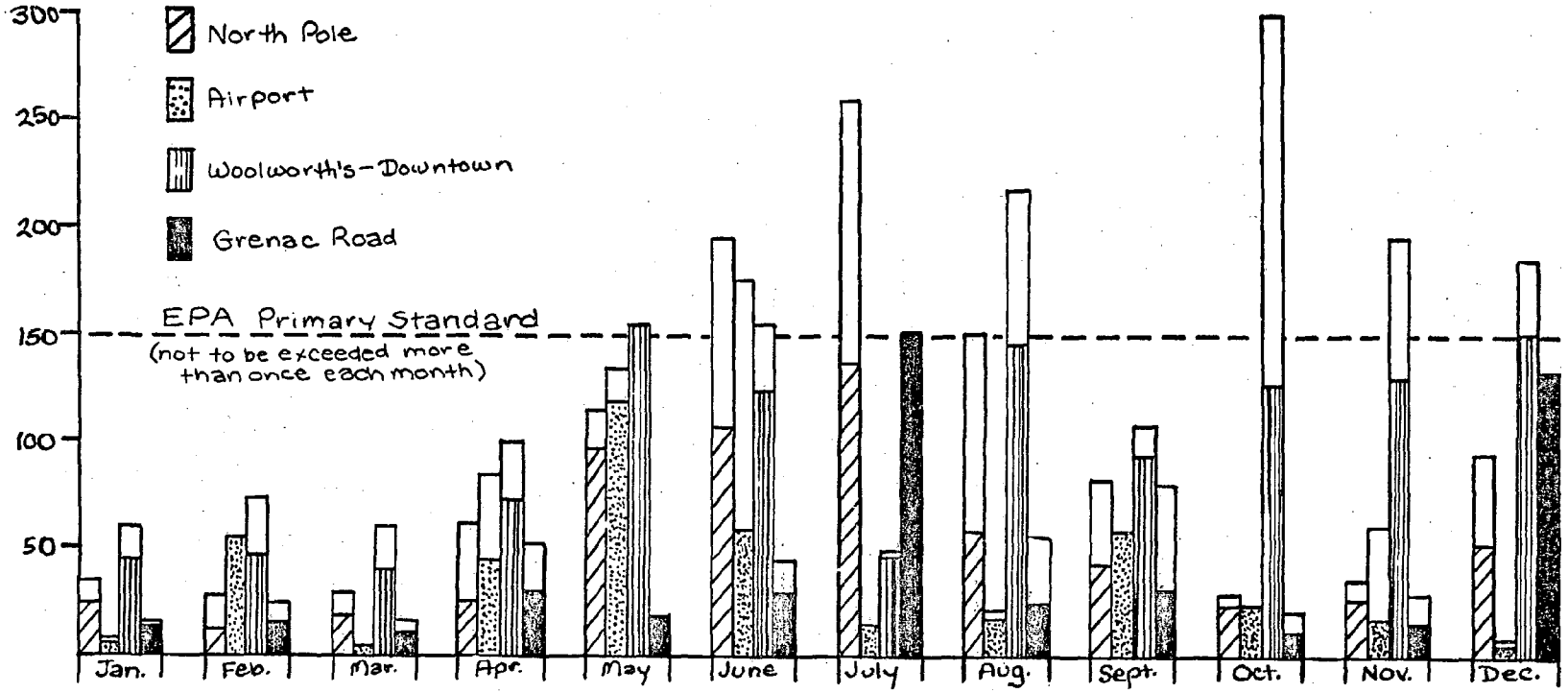
AIR QUALITY SUMMARY
Fairbanks North Star Borough
1973-1976

	Carbon Monoxide			Particulates
	Days with 8 hr. periods		Air Quality	24-Hr. Periods
	Exceeding 9 ppm	Exceeding 15 ppm	Alerts	Exceeding $150\ ug/m^3$
1973				
June	1	NA	NA	5
July	2	NA	NA	1
August	0	NA	NA	0
September	2	NA	NA	16
October	8	4	NA	3
November	22	8	4	0
December	31	25	17	2
1974				
January	29	18	17	0
February	24	8	4	0
March	19	4	1	0
April	6	1	0	2
May	5	1	0	2
June	1	NA	NA	2
July	1	0	0	2
August	7	0	0	1
September	7	0	0	7
October	11	1	NA	4
November	16	3	1	0
December	12	3	2	0
Total	138	39	25	20
1975				
January	17	6	2	0
February	14	3	0	0
March	6	0	0	0
April	0	0	0	0
May	0	0	0	0
June	2	0	0	3
July	0	0	0	2
August	0	0	0	2
September	0	0	0	0
October	7	0	0	1
November	11	2	3	2
December	15	4	3	10
Total	72	15	8	20
1976				
January	18	6	4	NA
February	12	3	2	1
March	0	0	0	0
April	0	0	0	0
May	0	0	0	0
June	0	0	0	6*
July	0	0	0	3
August	0	0	0	0
September	0	0	0	0
October	2	0	0	0
November	10	3	1	3
December	17	8	2	0
Total	59	20	9	13

*Partially due to forest fire activity

Source: Fairbanks North Star Borough, Department of Environmental Service.

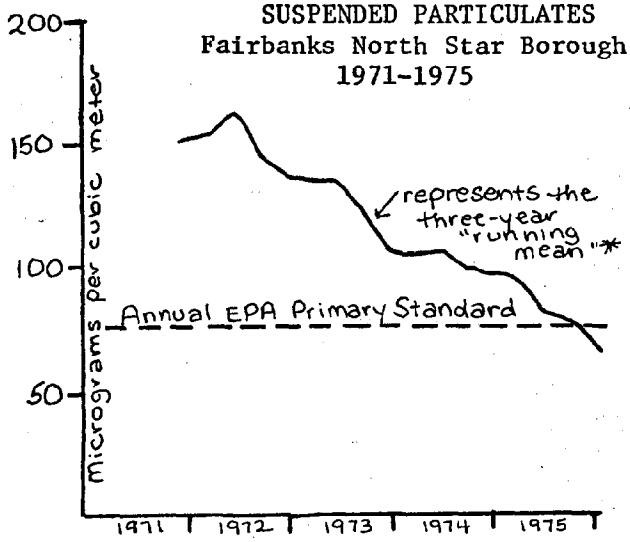
Figure 23
PARTICULATE POLLUTION COUNTS*
Selected Fairbanks Locations
1975



* Upper part of each bar is the high for the month, lower portion is the monthly average.

Source: Fairbanks North Star Borough, Environmental Services Department.

Figure 24
SUSPENDED PARTICULATES
Fairbanks North Star Borough
1971-1975



* Three-year running mean - eg. Each quarter in 1971 represents the average of the particulate counts for that quarter in 1969, 1970 and 1971.

Source: U.S. Environmental Protection Agency - National Air Surveillance Network Report, 1957-1976.

these fires are located far outside the Fairbanks airshed but still register on the borough monitors. The control of this "naturally" occurring pollution is limited to road paving, watering, or in some cases, cessation of the disturbing activity, such as extinguishment of forest fires. Other particulate sources include almost any combustion process to a greater or lesser degree.

The improving trend in particulate pollution indicated in Figure 24 is attributed largely to the increase in paved streets and decrease in forest fires since 1971. It is again significant that this improvements occurred coincidentally with an increase in population and construction.

Fairbanks North Star Borough Air Quality Program

In 1972 the Fairbanks North Star Borough formed an Environmental Services Department to coordinate a local effort to combat this deteriorating air quality situation. A Transportation Control Plan, proposed by the Federal Environmental Protection Agency for Fairbanks had met disfavor with local residents, the state government, and eventually, a federal court. Following the court decision, some citizens who were alerted to the seriousness of the air quality problem worked through

the borough government to develop an Air Quality Improvement Plan to address the situation at a local level.

This plan approaches the Fairbanks air quality problem through five distinct but inseparable elements. These elements are:

1. Traffic Management
2. Parking Management
3. Combustion Engine Emission Reduction Research
4. Air Resource Planning
5. Transportation Alternatives

The Air Quality Improvement Plan, as revised, was adopted in November, 1974, and each element implemented to some extent in 1975 and 1976. As a result of this initiative, Fairbanks has perhaps stayed the rate of air quality deterioration, but there is still need for improvement in air quality locally. The progress and goals of each component of the plan are reviewed in the following pages.

Traffic Management - Generally, improvements that ease traffic congestion and facilitate a smoother flow will reduce air pollution by carbon monoxide. In 1974 Fairbanks was having problems with traffic congestion. For reasons other than air quality, traffic patterns were changed to incorporate more one-way streets and improved signal systems. Even as the number of automobiles increased with the general community growth, the borough observed a slight reduction in CO levels which may be attributed to many factors, including both traffic improvements and weather. Often, changes made to allay wastes of time, money, energy, or other inefficiencies will result in an attendant reduction in the pollutant load. Traffic management is one such example and is therefore one of the more popular abatement measures. It is anticipated that the new Steese by-pass and other major changes contemplated will considerably enhance air quality. However some anomalies still exist, such as a major one-way arterial passing through a commercial store parking lot, which may be potentially dangerous.

Parking Management - A close relative of traffic management, parking management demonstrates the inseparability of elements in the Air Quality Improvement Plan. A plan to conveniently accommodate the vehicles that come to the city's commercial area is essential to the economic and physical health of that area; but it also affects air quality, since parking lots attract and concentrate vehicles.

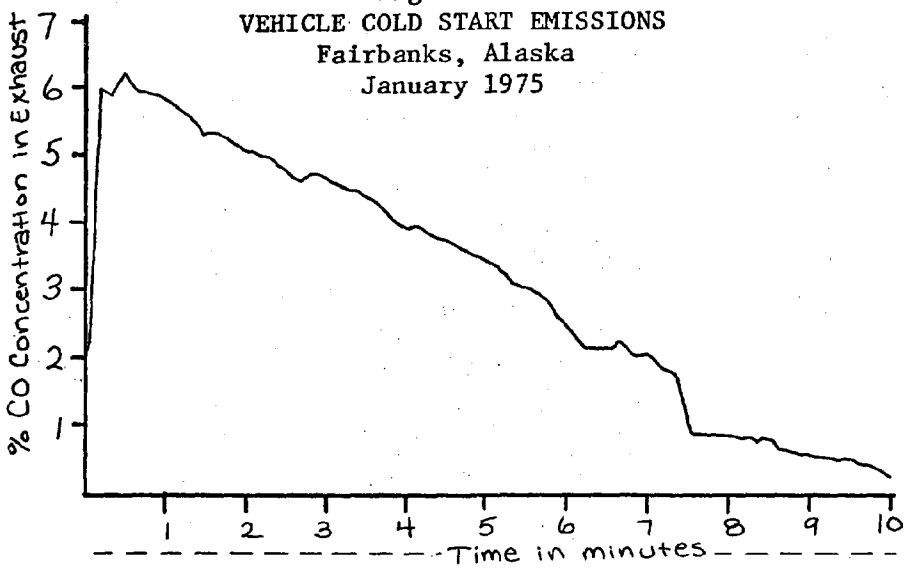
A summary of the Parking Management Study's findings on CO pollution in parking lots is presented in Table 23. Each parking space in the city core was inventoried; and a representative sample of these spaces was monitored closely for parking habits - including duration, frequency of use, and time of use. From this information, the amount of carbon monoxide each type of parking space contributed to the atmos-

Table 23
SURVEY OF CARBON MONOXIDE (CO) POLLUTION
Downtown Fairbanks Parking Lots
January 1976

Parking Category	-----Spaces----- Number	Percent	-Carbon Monoxide- kg/Day	Percent	Estimated Cars/Day	CO/car grams/day	CO/space grams/day
On-Street	1,380	22%	521	20%	3,432	149	483
Unrestricted	991	16%	297	11%	1,788	170	300
Special Zones	113	2%	67	3%	462	144	580
Metered	276	4%	157	6%	1,182	133	569
Off-Street	5,024	78%	2,111	80%	10,480	235	438
Metered	422	7%	300	11%	2,069	145	711
Government	908	14%	299	11%	885	337	329
Commercial	2,745	43%	1,276	49%	6,645	193	465
Private/ Professional	949	15%	2,235	9%	881	267	248
TOTALS	6,404	100%	2,632	100%	13,912	198	457

Source: Fairbanks North Star Borough Parking Management Study, 1976.

Figure 25
VEHICLE COLD START EMISSIONS
Fairbanks, Alaska
January 1975



Source: Cold Start Automotive Emissions in Fairbanks, Alaska, July 1, 1975, by L.E. Leonard.

phere was calculated and recommendations were made for adjustments to parking patterns with respect to air quality.

The data in Table 23 was collected through a temperature range of -26°F to -34°F and during an air quality "alert" (CO greater than 15 ppm). Perhaps the most significant results of this study are the CO emission per car and emission per space figures. These amounts are high compared to those in a warmer climate because of the lowered-combustion efficiency of an engine during its initial operation under very cold conditions. This leads directly to the next plan element.

Combustion Engine Emission Reduction - The source of over 90 percent of Fairbanks' carbon monoxide is the automobile. Thus, the Air Quality Improvement Plan attempts some reduction in CO emissions through improving the efficiency of automobile engines, which also ought to lessen the wastes of fuel, money and time.

To further this effort, the borough has supported research on the "cold-start emissions" problem. The sum and substance of this effect can best be illustrated by Figure 25 which was taken from a research paper on the subject. (Cold Start Automotive Emissions in Fairbanks, Alaska, July 1, 1975, by L.E. Leonard.)

Figure 25 shows that when an internal combustion engine is started under cold conditions it emits an excessive amount of CO as it warms to normal operating temperature. Although many details and complexities are being revealed in the research on this effect, the implications for Fairbanks' air quality are significant. Fairbanks has a lot of cars and a lot of cold weather. A combination of research on cold starts

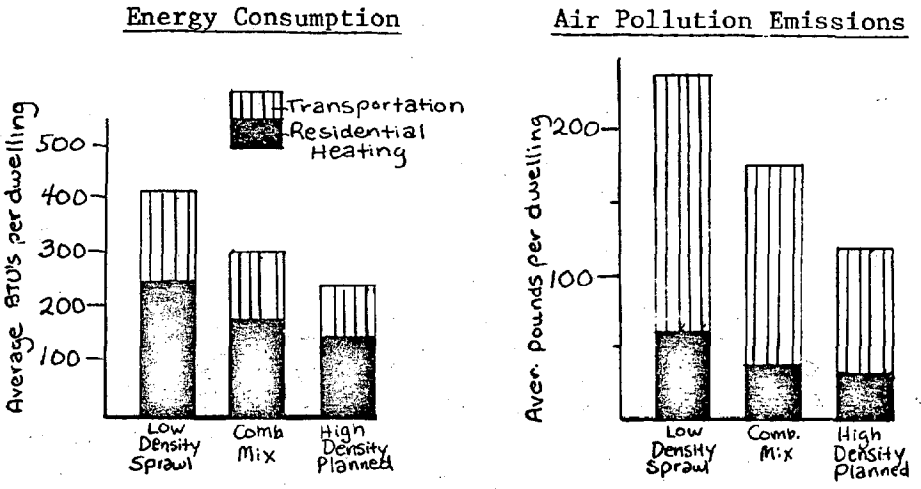
and data from the parking management study has shown that approximately 65 percent of the ambient carbon monoxide in the Fairbanks core area is contributed by cold start emissions (Parking Management Study, pp. 65-67.) Another research finding is:

> *None of the pollution control devices presently in common use are effective in reducing the cold start CO emissions. (Cold Start Automotive Emissions in Fairbanks, Alaska, July 1, 1975, by L.E. Leonard.)*

Currently, the only commonly effective methods of reducing cold starts are energy intensive, such as heated garages or head-bolt heaters. This fact has bearing upon pollution from power generation. However, local research has also developed some unconventional solutions to this dilemma. An example is a device that stores heat normally wasted during engine operation and uses it to again warm the engine after it has been left standing in cold condition. A working prototype of this device is available and shows promise. This is but one example which illustrates how the uncommon problems of Fairbanks' air quality may require novel solutions and the importance of a local research effort to meet these needs.

Air Resource Planning - Basic to all environmental issues is the use of the land. The environment of Interior Alaska requires very careful cognizance of land use in order to maintain the health of its

Figure 26
ENERGY CONSUMPTION AND AIR POLLUTION
For Different Development Patterns



Source: "The Costs of Sprawl" by the Real Estate Research Corporation, U.S. Government Printing Office, 1974.

systems and inhabitants. This section of the Air Quality Improvement Plan calls for consideration of the Fairbanks airshed as a resource affected by the planning decisions regarding the land it covers.

The relationship of development patterns as they affect the considerations of energy consumption and air pollution can be concisely illustrated by Figure 26 taken from a national data base.

Air resource planning also includes the collection and use of data regarding air quality. It provides the necessary feedback to indicate trends and direct the effort that anticipates potential problems.

Transportation Alternatives - As Fairbanks continues to grow, the near linear increase in people and automobiles crowd a once-adequate street and road system. Greater physical distance between community facilities further confirms the citizen's dependence upon the auto.

Transportation alternatives include public transit, car pools, bicycle paths, or any system that mitigates the one car - one person situation. The social and convenience benefits of these alternatives generally encourage their use more so than a concern for air quality. However, the other management and planning programs of the Air Quality Improvement Plan are greatly assisted by the availability of transportation to those who, for any number of reasons, do not wish to be limited to an individual auto.

Epilogue

This report has attempted to collect and convey some of the history and statistics related to energy use in the Fairbanks airshed. This has been done in a rather broadbrush fashion in the interest of brevity and clarity.

It is beyond the scope of this report to fully analyze the importance of this subject for those who live in Fairbanks. The following comments by the Environmental Services Department of the Fairbanks North Star Borough address some of the major implications of the data in this report:

> *Fairbanks consumes a per capita quantity of energy comparable to the industrialized cities of the Eastern United States. Yet, Fairbanks is not an industrialized city. It would be a mistake to infer from this that energy consumption and air pollution are preclusive to further economic development of Fairbanks, but neither should growth be allowed in such a manner as to further denigrate the community's health. What is needed is a balanced effort to enhance one goal with the other.*
>
> *Throughout the preceding report, examples were given demonstrating the fundamental fact that pollution is predicated on*

waste. It may be a waste of fuel, electricity, land, or any of a number of resources; but this fundamental holds. It is therefore apparent to many that the foundation of our clean-up effort should start with the elimination of the abuse of our resources. It is heartening that, even as this is being prepared, our city government is hearing proposals to salvage some of the energy lost as thermal discharge from the Municipal Power Plant to the Chena river, and on occasion, to ice fog.

Prometheus' presumptuous gift of fire has some novel implications indeed for the Fairbanks airshed, but the experience of the recent and continuing energy shortages should by itself instruct prudent use of fuel. The text of this publication is replete with graphs and data tending rapidly upward. We should keep in mind, however, that infinity only exists in metaphysics or mathematics. In the real world, the finite nature of the resources these curves represent becomes apparent.

The imperative to match our resources to our needs has, in fact, enhanced our concern for the environment by pushing our conscience beyond aesthetics and into management. We hope that Fairbanks, the All-American City, would accept this attitude as its escutcheon for the future.

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